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EFFECTIVENESS OF AERIAL SEEDING IN RECLAMATION OF CHAMBAL RAVINES IN MADHYA PRADESH*

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Introduction

Ravines occupy about 3.20 lakh hectares of land along Chambal river and its tributaries in Morena and Bhind districts of Madhya Pradesh. They form a continuous belt of 5–6 km width along the river Chambal. Soils in ravinous areas are generally deep and well drained. The soil is friable and thus very susceptible to erosion.

Ravines are constantly damaging the valuable fertile land, rendering it unfit for cultivation and agricultural use. As a result of ravine formation, there is loss of land and consequent shortage of food, fuel and timber for human beings and fodder for cattle. The habitation is encroached by advancing gullies. According to an estimate the ravines are advancing @ 0.50 per cent equivalent to about 800 ha new ravines developing every year (Anon., 1972). As a result the people are compelled to shift their dwelling sites. Due to continuous process of deepening of gullies, the water-table goes down which results in moisture stress for crops and greater hardship for men and cattle to obtain drinking water. The ravine lands pose a socio-economic problem also as they provide hideouts to dacoits and other anti-social elements engaged in nefarious activities. The ravine lands are one of the chief sources of sediments resulting in the silting up of the reservoirs.

The ravines are alarmingly extending every year Sharma (1979) reported 0.683 million hectares of ravine land in the entire State of Madhya Pradesh and 0.317 million hectares along the Chambal river and its tributaries in Bhind and Morena districts. Shallow ravines have been reclaimed through levelling and terracing for agriculture (Anon., 1982). About 75 per cent of deep inaccessible ravines still await reclamation through reforestation (Sharma, 1985).

It is being increasingly felt that vast stretches of ravine lands should be brought under proper vegetal cover. This needs quicker methods of afforestation in view of the magnitude of the problem. The afforestation technique should aim at covering large and inaccessible area in as short a time as possible. Aerial seeding seems to be the possible answer Aerial seeding is best suited to sites where inaccessibility, difficulty in physical movement and ruggedness of the terrain render planting by conventional methods on a large scale, exceedingly, difficult (Anon., 1983).

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Broadcasting of forest seeds from the aircraft is a recognized technique in Australia, New Zealand, Canada, Indonesia and USA particularly for seeding pastures. Forests have also been raised in suitable areas through this technique (Lyon and Thomson, 1979; Riley, 1980). In China, aerial sowing was tried over an area of 18,600 mu (15 mu = 1 hectare) in 1977–79 (Cao *et al.*, 1981).

Aerial seeding in India is still in experimental stage in the States of Maharashtra, Uttar Pradesh, Rajasthan and Madhya Pradesh Aerial seeding was first tried in this country in 1950 in Gujarat State to stabilize sanddunes (Sharma, 1985). This programme was started in Madhya Pradesh in the year 1980 under the pilot project taken up by the Chambal Command Area Development Authority (Bapat, 1980). The operation was continued by the same agency in the year 1981 over an area of 2,000 hectares. In 1982, other States also took up aerial seeding. About 2,000 hectares in Madhya Pradesh 1,720 hectares in Rajasthan and 863 hectares in Uttar Pradesh were brought under this operation. In 1983, 1984 and 1985 aerial seeding was again carried out in Madhya Pradesh, Rajasthan and Maharashtra (Anon., 1983; Sharma, 1985).

Assessment of aerial seeding carried out between 1980-84 in Chambal ravines was done by State Forest Research Institute, Jabalpur. Results of assessment in areas seeded upto 1984 have already been published (Sharma, 1985). Since then increasingly more and more area has been aerially seeded About 8,500 hectares in 1985 and 30,000 hectares in 1986 have been covered by aerial seeding. In addition, reseeding has also been carried out in areas already covered by aerial seeding in the past. Performance of aerial seeding and reseeding of areas since 1980 has been reported in this paper.

Site description

The ravines of the Chambal and its tributaries are located between latitudes 26°N and 27°N and longitudes 77°E and 79°E. The river Chambal forms the inter State boundary between Madhya Pradesh and Rajasthan. The river flows from West to East through deep alluvial deposits, resulting in heavy soil erosion in the tract,

Diurnal variation in temperature and erratic rainfall with limited number of rainy days are the characteristic climatic parameters making this area a semi-arid tract.

The summer period extends from March to June; the rainy season from July to October and the winter season from November to February. Mean minimum temperature of 8°C is observed during December and January, while mean maximum temperature of 48°C is recorced during May and June. Average annual rainfall in the region is about 800 mm. About 70 per cent of the total rainfall is received between July and August.

Soil in the Chambal region falls under the broad group deep alluvial soils (Sharma, 1979). These soils have developed from transported material brought by the Chambal river and its tributaries Since the material is recently deposited, soils do not exhibit horizon differentiation and hence are named as "recent alluvium". The soil samples collected from different areas of Chambal ravines in Morena and Bhind were analysed which gave an average pH value of 8.1 sand as 36.6%, silt and clay 63.0%, calcium carbonate 17.6%, and organic carbon as 0.18% (Prasad, 1986).

The natural vegetation of the ravine land consists of *Prosopis juliflora*, *P. spicigera*, *Acacia leucophloea*, *A. nilotica*, *A. catechu*, *Balanites aegyptica*, *Dichrostachya nutans*, *Zizyphus jujuba*, *Capparis aphylla*, *C. horrida*, *Salyadora oleoides*, *Adhatoda vasica*, *Carissa spinarum* and local coarse grasses. The vegetation has been destroyed by encroachment of cultivable land, uncontrolled grazing, illicit fellings and fires. The tract is treeless and the vegetation is mostly bushy and of xerophytic type.

Materials and Methods

Most of the deep ravines are located along the river Chambal and its tributaries. The total area under various categories of ravines is 3.107 lakh hectares. Out of this, about 0.738 lakh hectares of area (23.7%) of shallow ravines have been reclaimed through levelling and terracing for growing agricultural crops. The remaining area of 2.37 lakh hectares (76.3%) of the moderately deep. deep and very deep categories is being reclaimed through soil conservation and reforestation by aerial seeding since 1980 (Bapat, 1980). Table 1 shows the area covered under aerial seeding from 1980 to 1986. The detailed account of species

Table 1

Area coverage by Aerial seeding

Year	District-wise area covered in hectares				Total seed used kg/ha		
	Morena		Bhind		Seeding	Reseeding	Total
	Seeding	Reseeding	Seeding	Reseeding			
1980	503	—	—	—	15.30	5.70	21.00
1981	1000	500	1000	—	13.45	26.55	40.00
1982	1000	1000	1060	1000	15.00	20.00	35.00
1983	–	2500	1500	200	—	20.00	20.00
1984	4000	—	2500	2360	20.00	5.00	25.00
1985	6000	4000	2500	2500	20.00	5.00	25.00
1986	23000	—	7000	—	20.00	—	20.00
Total	41503	8000	15560	6060	—	—	—

selection, composition of seeding mixture, pre-sowing seed treatments, mixing of seeds with farm yard manure and forest soils have been given by Sharma (1985). The quantity of seed used per hectare was 15.3 kg, 13.4 kg, 15.0 kg, 20.0 kg and 20.0 kg in 1980, 1981, 1982, 1083 and 1984, respectively (Anon., 1984). The seed mixture used in 1984–85 and in 1986 have been given in Table 2. Invariably untreated seeds were used for aerial seeding. In case of *P. juliflora*, crushed pods were used for aerial seeding.

Beaver type of aircrafts, were used with load carrying capacity of 800 kg per sortie. These planes made as many as 30 to 40 sorties in a day and the seeding over an area of 2,000 ha was completed within 4 days (Anon., 1983). However, when Beaver type plane was not available the seeding was carried out by other type of aircraft. In 1986, the Air Force Dakotas were also used for aerial seeding. These planes operated from permanant air fields from Gwalior and Agra as *Kachcha* air-strips are not suitable. While other agro-aviation planes can fly as low as 15 m–30 m above-ground level, Dakotas fly at a height of about 300 m. As a result much of the seed is normally blown away. This plane was found to be not effective as many times the aircraft dropped the huge seed stock at one or two places in every sortie. Farmers and villagers, invariable complain that the seed was air dropped in their grain-yard, on house tops and on agricultural fields.

Method of evaluating the success

Appraisal of aerial seeding in 1983–84 was carried out by laying out quadrats of size 10 m × 10 m at random. In all 90 quadrats in Morena and 80 in Bhind area spread over an area of 4,000 ha in Morena-Bhind were covered. The extent of area covered since 1984 has been sharply increasing where any systematic ground survey on the basis of horizontal distance appeared almost impossible as the extremely rugged topography made the task difficult. Random laying of quadrats was also not

Table 2

Proportion of different species in the seed mixture

Species	Year-wise proportion of seed mixture (kg/ha)						
	1980	1981	1982	1983	1984	1985	1986
Prosopis juliflora	7.38	8.04	7.30	10.90	10.90	10.50	5.00
Acacia nilotica	2.34	5.11	7.02	7.00	7.00	7.00	8.00
Acacia catechu	1.02	—	0.58	2.00	2.00	2.00	1.00
Miscellaneous spp.	4.49	0.30	0.05	0.10	0.10	0.60	1.00
A. leucophloea	—	—	—	—	—	—	1.00
Dychostrachys spp.	0.02	—	—	—	—	—	1.00
Dendrocalamus strictus	—	—	—	—	—	—	2.00
Legumes and *grasses*	0.05	—	0.05	—	—	—	1.00
Total	15.30	13.45	15.00	20.00	20.00	20.00	20.00

found suitable for such a vast and highly cut-up ravinous areas. Improvisation in sampling technique was therefore, thought of Under this method the base line along the village boundary was marked on the map and identified on the ground. Alternate boundary pillars at an approximate distance of 400 m was selected. From these points, a party leader accompained by 6 members was given a hand compass and other material. The parties then proceeded towards Chambal river walking for 10 minutes. Any calibration of time and distance was not possible and therefore, it was presumed that each party walking with almost same speed must have covered the equal distance. At this point of time (and space) the parties were required to lay 3 quadrats, (10 m × 10 m) one at gully top, another on the slope and third in the gully bed. After enumerating the seedlings species-wise, the parties were required to move towards Chambal river with the help of hand compass. Moreover, while walking one can align himself in the direction of Chambal river as the distance between starting point to river varies from one to two kilometres. With this method, seeded and re-seeded areas of 1980-85 have been covered by laying out 967 quadrats. Two categories of plants presumably of aerial seeding origin viz., established plants (above 15 cm tall, green and healthy plants) and unestablished plants (less than 15 cm tall, lanky plants) were counted for each species. Healthy and established seedlings were mostly confined to sites where soil compaction was not visible. Sheltered places and crevices also supported better growth. Seedlings of thumb thickness and 15-30 cm height were observed to be growing well. These plants were not likely to suffer mortality on account of moisture stress and therefore were considered as established plants. However, it was only an accular estimate as no height or girth was recorded. The results of seedling counts were then tabulated and statistically analysed.

Results and Discussion

Data pertaining to seedling count in areas which were aerially seeded between 1980-85 have been presented in Table 3. These areas were re-seeded in subsequent years. In some areas the re-seeding was repeated more than once. For the purpose of seedling counts 97 quadrats were laid out in areas which were seeded in 1980. In 1981 area, the number of quadrats was 127; in 1982 area 173, in 1984 area 361 and in 1985 there were 209 quadrats. These quadrats were laid-out in gully bed, on slope and on compacted gully top. In all, 326 quadrats were laid in gully bed, 323 along slope and 318 on gully top which is compact and comparatively less erodible. Slopes are most susceptible to soil erosion. Gully beds are somewhat stabilized and therefore, provide comparatively better germination and growing conditions to the fallen seeds. But the seeds fallen on hard surface as well as along slope are liable to be washed-off even with light rainfall. However, the soil being loose and friable along gully slopes, the seeds have a fair chance of germination.

Perusal of data on seedling count (Table 3) carried out in June 1986, invariably showed higher number of seedlings in gully bed followed by gully slopes and gully top. As already discussed the gully tops are invariably very compact and hard. Water infiltration on such sites is very poor.

Table

Seedling count –

Year of seeding	Year of re-seeding	Total area covered	Topography	No. of quadrats (10 m × 10 m)	Area of quadrats in ha.	Babul (*Acacia nilotica*)
1	2	3	4	5	6	7
1980	1983-84	503	Gulley bed	33	0.33	93
			Slope	32	0.32	21
			Top	32	0.32	8
			Total	97	0.97	122
			Mean	—	—	40.67
1981	1983-84	1,000	Gulley bed	43	0.43	61
			Slope	42	0.42	46
			Top	42	0.42	33
			Total	127	1.27	140
			Mean			46.67
1982	1983-84	1,000	Gulley bed	60	0.60	305
			Slope	57	0.57	62
			Top	56	0.56	41
			Total	173	1.73	408
			Mean			136.00
1984	1984-85	4,000	Gulley bed	120	1.20	2,173
			Slope	121	1.21	1,185
			Top	120	1.20	709
			Total	361	3.61	4,067
			Mean			1355.67

3

Aerial Seeding Area

Kikar (*Prosopis juliflora*)	Neem (*Azadirachta indica*)	Khair (*Acacia catechu*)	Siris (*Albizia lebbek*)	Chrol (*Holoptelia integrifolia*)	Bans (*D. strictus*)	Sissoo (*Dalbergia sissoo*)	Total
8	9	10	11	12	13	14	15
61	2	20	—	—	—	—	176
35	2	22	—	—	—	—	80
16	1	3	—	—	—	—	28
112	5	45	—	-	—	—	284
37.33	1.67	15.00	—	—	—	—	94.67
347	—	6	—	2	—	3	419
115	—	7	—	—	—	—	168
101	1	3	—	—	—	—	138
563	1	16	—	2	—	3	725
187.66	0.34	5.34	—	0 66	–	1.00	241.67
232	3	6	—	—	—	—	546
144	6	20	2	—	—	—	234
103	8	2	—	—	—	—	154
479	17	28	2	—	—	—	934
156.67	5.67	2.34	0.66	—	—	—	311.34
705	1	48	—	—	99	—	3 026
649	2	56	—	—	5	—	1.897
439	4	39	—	—	—	—	1.191
1,793	7	143	—	—	104	—	6.114
597.67	2.33	47.67	—	—	34 66	—	2038.00

(Contd...)

1	2	3	4	5	6	7
1985	1985-86	1,000	Gulley bed	70	0.70	962
			Slope	71	0.71	487
			Top	68	0 68	290
			Total	209	2.09	1,739
			Mean			579.67
Grand Total		7,503		967	9.67	6,476

Presence of small calcarious nodules indicates the advanced stage of erosion. The seeds dropped on such hard surface are thus not able to establish even though they are able to germinate. Only those seeds which happen to fall on sheltered depressions on the gully top have some chances of establishment.

Aerially seeded areas of 1980 1981 and 1982 were re-seeded in 1983-84. The mean seedling count per hectare in these areas was very low; it was 94 67 in 1980; 241.67 in 1981 and 311.34 in 1982. Comparatively higher plant population was observed in 1984 (2038.00 plants/ha) and 1985 (942.69 plants/ha) areas. As has been reported earlier by Sharma (1985) heavy mortality in seedlings takes place after the germination. In 1980 area, the seedling count of 824 was observed after 3 months of aerial seeding (September, 1980). The mortality continued as the number of seedlings reduced to 742 in November 1980, 642 in February 1981, 552 in June 1981 and 412 in November, 1981. Similarly in 1981 area of Morena, the plant population of 225 counted in October 1981, was found reduced to 86 in February 1982 and to 74 in June 1982. In Bhind area, in the same period, the initial population count of 630 was found to be 183 in February 1982 and 140 in June 1982. Similar, trends of mortality were recorded in other areas also (Table 4). In 1980 area, out of 824 plants recorded in September 1980 only 556 plants were observed in October 1984 and only 95 in June 1986. Heavy mortality was also seen in 1981 and 1982 areas (Table 4).

These facts indicate that presently higher number of seedlings in 1984 and 1985 may also decline unless the areas are protected from biotic pressures as well as by intensive soil conservation measures. The importance of soil and water conservation measures is further supported by the findings of Shankaranarayan and Kumar (1986) who reported higher seedling population on mulched crests, leeward slopes and ploughed interdunes, in aerially seeded sand dunes in Rajasthan. It is generally argued that if soil working is to be done manually, there is no need for aerial seeding. This arguement is partly true because soil conservation measures including engineering measures are 'one–time–operation' while planting would require frequent visits. Since there are difficulties in physical movement it is recommended that masonary

8	9	10	11	12	13	14	15
443	—	31	—	—	12	—	1,448
293	3	27	—	—	8	—	818
211	4	27	—	—	30	—	562
947	7	85	—	—	50	—	2,828
315.67	2.33	28.33	—	—	16.67	—	942.67
3,894	37	317	2	2	154	3	10.88

Table 4

Comparative seedling counts and Survival Pattern

Month/Year of counting (Not done on regular interval).	Average number of plants per ha					
	1980	1981	1982	1983	1984	1985
September, 1980	824	—	—	—	—	—
November, 1980	742	—	—	—	—	—
February, 1981	642	—	—	—	—	—
June, 1981	552	—	—	—	—	—
October, 1981	412	225	—	—	—	—
February, 1982	388	86	—	—	—	—
June, 1982	305	74	—	—	—	—
October, 1984	556	714	800	—	988	—
June, 1986	95	242	311	—	2038	943

checkdams be made on watershed basis. Small structures can be made as per requirements. The would help to stabilize the ravines and at this stage aerial seeding even manual broadcasting supplemented by planting can be done.

Though, a large number of species were used in aerial seeding (Table 2), the best results in terms of higher plant population was observed with *Acacia nilotica*, *Prosopis juliflora* and *A. catechu* (in descending order). Other species such as *Azadirachta indica*, *Albizia lebbek*, *Holoptelia integrifolia*, *Dendrocalamus strictus*, *Dalbergia sissoo* and the grasses and legumes were found missing from the quadrats.

Range of Variation in Seedling Counts : Data presented in Table 5 indicates the variability in the seedling population in different years of aerial seedling. With the exception of 1980 and 1985 (in gully beds) the variation in seedling count was found to be zero to 607.67 in 1980; – 1769.67 in 1981;–1216 67 in 1982; – 2993 in 1984 and zero to 2143 in

1985 of aerial seeding. Further examination of data also raveals that the ratio between unestablished and established plants is about 1 : 4, 1 : 1, 1 : 1.7, 1 : 0.03, 1 : 0 02, in 1980, 1981, 1982, 1984 and 1985 areas, respectively. As expected, after 6 years of aerial seeding the unestablished seedlings are about 25% of the established seedlings but in subsequent years the difference between established and unestablished seedlings is narrowed down. This also indicates, that in 1981 and 1982 areas, though the aerial seeding was done about 4–5 years ago, the proportion of unestablished seedlings is quite substantial. Younger plants in the older areas are the result of re-seeding, sometimes done more than once. Due to inhospitable conditions in Chambal ravines, the rate of mortality is also very high and therefore, the process of establishment is delayed. Continuous trampling, browsing and cutting of older twigs for fuel has further aggravated the problem.

Under normal plantation programme, a plant population of 2,500 plants/ha (spacing of 2 m × 2 m) can be expected In high-density plantations, the spacing is reduced to 2 m × 1 m or 1 m × 1 m with a corresponding plant population of 5,000 and 10,000 plants per hectare, respectively, can be expected. The foremost objectives of reforestation on such a degraded site would be to reclothe the number of plants per hectare are not enough to entitle it as a successful aerially seeded area.

Cost Calculation of Survived Plants: Chambal Command Area Development Authority (CADA, 1986) reported the average cost of Rs. 250 to Rs. 300 per hectare in aerial seeding as compared to Rs. 3,000 to 4,000 per hectare under the conventional method of planting. It has also been calculated by CADA (1986) that the cost per surviving plant comes of Rs. 0.25 only. On the basis of these calculations, the Chambal Ayacut Development Authority, Gwalior has published this programme as the cheapest method of reforestation. However, their financial analysis needs more scrutiny.

Internal monitoring reported to have been done by aerial seeding wing of CADA has presumed a surviving seedling population of 1000–1200 plants per hectare which is only 50 per cent of the normal conventional planting population. Since the extent of monitoring, and the methodology of monitoring has not been described by CADA, it is difficult to accept their figures on survival and establishment of seedlings. Looking to the vastness of area, a few sample plots randomly laid out in unstatistical manner cannot be regarded to represent the vast rugged topography. Further, in a normal planting scheme the desired species can be ensured. As compared to this, the species mixture tried in aerial seeding is not able to ensure success in proportion of their contents in the seed mixture. As against about a dozen forestry species used in the aerial seeding mixture only three species of some commercial value viz, *A. nilotica*, *Prosopis juliflora*, and *A. catechu* have been found successful. The villagers, on the whole, do not subscribe to the story of success because they feel that these species are present as natural growth in this areas, in ravines, in village wastelands, around their fields and along roadsides. The goats, sheep the site as early as possible. The

Table 5

Range of variations in seedling counts—Morena areas

Year	Topography	No. of plants per hectare		Total	Range		Average	S.D. ±	SEM ±
		Established (E)	Unestablished (UE)		+ S D.	—S D.			
1980	Gulley bed	139	37	176	1037	29	419	504	88
	Slope	71	9	80	508	00	179	258	46
	Top	20	8	28	278	00	35	191	34
	Average	76.67	18 00	94 66	607.67	—	211.00	—	—
1981	Gulley bed	225	164	419	3108	00	445	2134	325
	Slope	101	67	168	1165	00	293	765	118
	Top	96	42	138	1036	00	232	707	109
	Average	150.67	91 00	241 67	1769 67	00	323.34	—	—
1982	Gulley bed	335	211	546	1900	00	645	989	128
	Slope	156	78	234	960	00	216	550	73
	Top	96	58	154	790	00	137	515	69
	Average	195.67	115.66	311.33	1216.67	00	332.67	—	—
1984	Gulley bed	82	2944	3026	5757	00	1655	3235	295
	Slope	49	1848	1897	3953	00	902	2375	216
	Top	6	1185	1191	2993	00	579	2001	183
	Average	65.67	1992.34	2033.00	4237.67	00	1045.34	—	—
1985	Gulley bed	34	1414	1448	3676	462	1763	1607	192
	Slope	20	798	818	2372	00	723	1220	145
	Top	22	540	562	2143	00	539	1317	160
	Average	25.3	917.34	942.67	2730.34	—	1008.34	—	—

soils in Chambal ravines are deep alluvial deposits of very high productivity. Such sites therefore, are capable of supporting higher plant population than normal sites.

The three most successful species in aerial seeding viz., *A. nilotica*, *A. catechu* and *Prosopis juliflora*, are normally grown for fuel and small agricultural timber. The total biomass, rather than the merchantable timber biomass would be the concern of forester in such areas. These species, can therefore, be raised at comparatively closer spacing. The plant population of 5,000-6,000 per hectare would thus be a logical figure for a successful aerially seeded area.

As would be seen from data given in Table 6 out of a total number of 967 quadrats studied 19.13% quadrats did not have any seedlings, 70.94% quadrats contained less than 2,500 plants/ha, 7.45% quadrats contained 2,501 to 5000 plants/ha and 2,48% quadrats contained 5,001 to 10,000 plants/ha. Further, 33 quadrats in 1980, 38 quadrats in 1981, 47 quadrats in 1982, 31 quadrats in 1984, 36 quadrats in 1985 (total 185 quadrats) which works out to 19.13% of total sampled quadrats did not contain any seedling. Similarly, 47 quadrats in 1985, 56 in 1981, 72 in 1982. 86 in 1984 and 49 quadrats in 1985 (total 310) which works out to 32.06% of the total sampled quadrats contained 100-500 plants/hectare. Further, 12 quadrats in 1980, 24 in 1981, 23 in 1982, 80 in 1984 and 35 in 1985 (total 174 quadrats 17.99% of the total sampled quadrats) contained only 600-1000 plants per hectare. Thus, 70.94% of the total sampled quadrats contained less than 1,000 seedling which too were in various stages of establishment. This shows that in majority of the cases regurgitate them in the field which also helps in establishing the population of these species. This contention is confirmed by the fact that these species do occur in non-aerially seeded areas of Chambal Ravines.

The cost calculation on basis of expenses given by CADA (1986) and the surviving plant population computed from 967 sample plots covering about 0.15 per cent of the total aerial seeding area in Morena district, have been summarised in Table 7. On the basis of this study average cost of Rs. 0.54 per surviving plant in Bhind and 0.55 per surviving plant in Morena district has been worked out. and The cost per plant in older areas is difinitely much higher than the cost in recently seeded area. This is mainly on account of continuous mortality in older areas which has tended to thin out the population to the present level of less than 500. Areas which received aerial seeding in the recent past do have higher plant population but its real test would be after 2-3 years and not now.

It we consider a normal stocking of about 3000-5000 plants per hectare for species expected to give optimum plant biomass at such sites, the present cost of Rs. 300-400 for an average plant population of about 300 may approach the norm of convential planting. However, looking to the edapho-climatic, biotic and socio-economic problems connected with the Chambal ravines, any plant growth would be a welcome result and should therefore, not be compared with normal plantation economics. The aerial seeding operation in Chambal ravines which was started in 1980

Table 6

Frequency of occurrence of seedlings in different quadrats

Range of variation in seedling count	Year-wise No. of quadrats in this category					Total No. of quadrats	Total No of plants observed	Av. No of plants per quadrats	Av. No. of plants per hectare	Percentage of area covered by these quadrats (%)
	1980	1981	1982	1984	1985					
0– 0	33	38	47	31	36	185	—	—	—	19 13
1–25	64	84	122	278	138	686	5,698	8.31	831	70.94
26–50	—	3	3	35	31	72	2,629	36.51	3651	7.45
51 & above	—	2	1	17	4	24	2,558	106.58	10,658	2.48
	97	127	173	361	209	967	10,885	11.26	1126	100.00

Table 7

Cost calculation of survived plants through aerial seeding in Chambal Ravines

Year of Seeding	Area (ha)	Period of air seeding	Year of Reseeding	Cost of air seeding	Overhead charge 10%	Cost of Reseeding	Cost of Protection	Total cost	Cost per ha (Rs.)	Surviving plant/ha (No.)	Cost per surviving plant (Rs)	Remarks
				(Rs. in thousand)								
BHIND DISTRICT												
1981	1000	11.7.81 to 18.7.87	1983	144.71	14.47	66.59	21.60	247.38	247.38	140	1.767	
1982	1060	1.7.82 to 3.7.82	1983-84	156.13	15.61	132.40	21.60	325.74	307.30	745	0.412	
1983	1500	23.7.83 to 31.7.83	1984	343.39	34.34	196 38	32.40	606.51	404.34	325	1.240	Counted in March '84
1984	2500	29.6.84 to 1.7.84	1985	549.50	54.95	296.26	54.00	954.73	381.89	100	3.813	
1985	2500	16.6.85 to 22 6.85	—	527 66	52.77	—	54.00	634.44	253.77	1360	0.186	
Total/Av.	8560	—	—	344.28	29 58	138.03	36.72	548 76	318.24	534.0	0.590	
MORENA DISTRICT												
1980	503	16 7.80 to 28.7 80	1981-84	386.17	38.62	111.67	21.60	558.06	1109.00	292	3.798	
1981	1000	9.7.81 to 12.7.81	1982-83	132.69	13.27	199.42	21.60	366.99	366.97	571	0.643	
1982	1000	30.6.82 to 30.7.82	1983	203.78	20.38	112.75	21.60	358.51	358.51	548	0.654	
1983	—	7.7.83 to 13.7 83	Old areas	—	—	—	—	—	—	—	—	
1984	4000	23.6.84 to 26.6.84	1985	777.04	77.70	516 28	36.40	1457.42	364 36	1692	3.215	
1985	1000	16.6.85 to 18 6.85	—	262.96	262.96	—	21.60	310.85	310 85	1360	0.224	
Total/Av.	7503	—	—	352.53	82.59	210.03	34.56	679.71	439.82	792.6	0 55	

over an area of 503 hectares in Morena district, by 1985 has covered an area of 21,063 hectares. About 67% of this area (14,060 ha) was also reseeded, some areas even more than once. In 1986 alone about 30,000 hectares were taken up for aerial seeding. At the time of monitoring in June, 1986. The aerial seeding operation was continuing and therefore, any indication of its performance (1986 areas) would be known only after a couple of months.

Varying quantity of seeds have been used in seeding and reseeding operations. The actual quantity of seed used in different years of seeding and reseeding has been given in Table 1. Perusal of data would indicate that 21.00 kg/ha was used in seeding and reseeding operations in 1980 areas, 40.00 kg/ha in 1981 areas, 35.00 kg/ha in 1982, 20.00 kg (only reseeding done) in 1983 areas, 25.00 kg/ha in 1984 and 1985 areas and 20.00 kg/ha, in 1986 areas. Taking an average figure of say 25 kg/ha, each hectare has received on an average, 8-10 lakhs of seeds. Perusal of data in Tables 3–5 shows highly variable seedling count in all the six years (1984-85) of seeding operation. The massive quantity of seed dropped from aircraft in the area is poorly reflected by the number of surviving seedlings. The seedling count in the quadrats has ranged from zero to 5,757/ha (Table 5). The seedlings are not uniformly distributed over the area. A large number of quadrats (19.13%) did not contain any seedling (Table 6). Still large number of quadrats (50.05%) contained less than 1,000 unestablished seedlings per hectare.

The heavy mortality in the seedlings is due to moisture-stress prevailing for more than 8-9 months In the ~~in this~~ area. Moisture is scarce as water retention capacity of the soil is very poor. Rainfall is confined to a very brief period between July to August. Termite attack is also noticed in the area. The problem is further worsened by uncontrolled grazing, trampling and browsing by goats, sheep and other cattle.

Chaturvedi (1983) has analysed the results of aerial seeding in Chambal ravines of Agra (U.P.). Species like *P. juliflora* and *Acacia nilotica* have been reported to be successful but *Dalbergia sissoo*, *Holoptelia integrifolia* and *Ailanthus excelsa* have been reported to be complete failure. The total number of seedlings in different plots was found to range from a minimum of zero to a maximum of 5,116 seedlings/ha. The appraisal of aerial seeding operation for a period of 1980-84 was done by this Institute (Sharma, 1985) and the result of monitoring (1980-85), reported in this paper confirms the findings of Chaturvedi (1983).

Aerial seeding operation have been extensively employed in countries like USA, New Zealand, Canada, Australia, Indonesia, Nigeria, China and in some States in this country also. Though the site conditions in these countries were not so inhospitable as prevailing in areas like Chambal ravines, only a limited success has been reported from these countries. An area of 370 hectares in Indonesia was aerially seeded in 1972 but the success was less than 30 per cent (Anon., 1983). Various workers who studied the effectiveness of aerial seeding in China (Cao *et al*, 1981), observed the seedling emergence with an average stocking of 16 plants/ha.

Riley (1980) considered a minimum stocking of 60 per cent as satisfactory norm. The emphasis in this study was placed on the receptive seed bed rather than on the quantity of seed used for aerial seeding. Levack (1973) concluded that for better results, aerial seeding should be supplemented by conventional planting. On this analogy, the theory that proper seed bed to hold the seed is a pre-requisite for success is undoubtedly applicable to the Chambal ravines also. This fact has been further brought out by Shankarnarayan and Kumar (1986) who demonstrated the effectiveness of soil and moisture conservation measures in ensuring better seedling emergence and establishment.

The present programme of aerial seeding is continuing in leaps and bounds. It is estimated that with the present rate of about 25,000 hectares seeded every year, the entire area of Chambal ravines can be liquidated by 1993-94 at an estimated cost of about Rs. 100 million. We have already used about 1,000 tonnes of seeds and if this programme is continued, another 4,000 tonnes of forest seeds would be required for aerial seeding.

The experience of other countries where the site conditions are a not as orphaned as that in Chambal ravines, indicate that aerial seeding is not a reliable tool to reforest the problematic areas like this. The present ambitious plan for aerial seeding of Chambal ravines is based on a premise that in such a rugged terrain sowing seed alone can prove to be the panacea of all evils. The receptivity of seed bed is not being given due consideration and as a result most of the seeds dropped from air-crafts is either washed away, do not germinate or the germinated seedlings succumb to the ensuing moisture stress conditions.

The experience of farmers in this area provides the clue for reclamation of Chambal ravines. Progressive farmers, with big chunks of lands in Chambal ravines have divided their areas on the basis of small water sheds Masonary check dams constructed in first year are required to be elevated in next 2-3 years to trap the silt flow. Over a period of 2–3 years, the areas have been seen growing cash crops like mustard and wheat. On above analogy the present programme of aerial seeding should be preceded by creating engineering obstructions on gullies. Other soil conservation measures, carried out on intensive scale may stabilize the slopes and provide receptive seed beds to seeds dropped from air craft. These operations if carried out 2-3 years in advance of aerial seeding, the entire programme can become a success story. The seed used in this programme also need thorough testing before it is released for use in aerial seeding operations.

SUMMARY

Chambal ravines extending over an area of about 3.20 lakh hectares in Bhind and Morena districts of northern Madhya Pradesh are being reclaimed through aerial seeding. This programme was started in 1980 in Morena over an area of about 503 hectares. About 21,063 hectares of ravines in Morena and Bhind areas were covered by 1985. Another 30,000 hectares were covered by aerial seeding in 1986 alone. It is now proposed to take up about

25,000 hectares annually and liquidate the entire ravinous areas by 1993-94. About 1,000 tonnes of forest seeds have been sown from air and another 4000 tonnes of forest seeds are required to be sown in next few years.

The appraisal of aerial seeding is being done by State Forest Research Institute, Jabalpur (M.P.) since 1981. Initial experience of carrying out systematic sampling has not been found feasible and therefore, an improvised 'time-distance' method of sampling described in this paper, was resorted to monitor the aerial seeding. In all 967 quadrats of size 10 m × 10 m were laid out on gully top, slopes and in gully beds. Seedlings were counted from these plots. The results were then statistically analysed.

Results available from this survey have shown that the seedling count is highly variable (zero to 5777). On an average 200-300 seedling/ha have been found in seeded areas. The results of aerial seeding, its practicability, operational convenience and economic feasibility vis-a-vis the recommendations and research needs have been discussed in this paper.

मध्य प्रदेश के चंबल बीहड़ों के पुनरसंस्करण के लिये विमान द्वारा बीज बोने की प्रभावशालिता

रामप्रसाद

सारांश

उत्तरी मध्य प्रदेश के भिंड और मुरैना जिलों में लगभग 3.20 लाख हैक्टेयर क्षेत्र में फैले हुए चम्बल बीहड़ों का पुनरसंस्करण विमान द्वारा बीज बुवाई करके किया जा रहा है। यह कार्यक्रम 1980 में मुरैना का लगभग 503 हैक्टेयर क्षेत्र लेकर शुरू किया गया। 1985 तक भिंड और मुरैना के बीहड़ों का लगभग 21,163 हैक्टेयर क्षेत्र इसमें लिया जा चुका था। लगभग 30,000 हैक्टेयर क्षेत्र विमान द्वारा बुआई करके इसमें और 1986 में लिया गया। अब इसमें प्रतिवर्ष लगभग 25,000 हैक्टेयर क्षेत्र बढ़ाते जाकर 1993-94 तक पूरा बीहड़ क्षेत्र पुनस्संस्कृत कर देना है। विमान द्वारा लगभग 1000 टन वन वृक्ष-बीज बोया जा चुका है तथा अगले कुछ वर्षों में वन वृक्षों का लगभग 4000 टन बीज और बो लिया जाएगा।

विमान द्वारा बीज बुआई का मुल्यांकन राज्य वन अनुसंधान संस्थान जबलपुर (मध्य प्रदेश) द्वारा 1981 से किया जाता रहा है। विधिवत् न्यादर्शन का प्रारम्भिक अनुभव करना सम्भव नहीं रहा इसलिए इस अभिपत्र में वर्णित न्यादर्शन की 'समय/दूरी' की अभिकल्पित रीति विमान बुआई की जांच-परख के लिए शुरू की गई। कुल मिलकर 10 मी० × 10 मी० आकार के 967 चतुष्कोणक जलदरी शिर, ढलान और जलदरी तल में बनाए गए। इन प्रक्षेत्रों के पौधे गिने गये। उससे मिले परिणामों का सांकियकीय विश्लेषण किया गया।

इस सर्वेक्षण से मिले परिणामों ने दिखाया है कि पौधों की गणनां में बहुत अधिक अन्तर है (शून्य से लगा कर 3777 तक)। बोये गये क्षेत्रों में औसतन 200-300 पौधे/हैक्टेयर जमे हैं। विमान द्वारा बुआई का परिणाम, इसकी व्यावहारिकता, कार्य करने की सुविधा और आर्थिक दृष्टि से संभाव्यता के साथ-साथ अभिस्ताव और अनुसधान की आवश्यकतायें भी इस अभिपत्र में विवेचित की गई हैं।

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PRESENT STATUS AND FUTURE PROSPECTS FOR THE CULTIVATION AND COLLECTION OF MEDICINAL PLANTS OF HIMACHAL PRADESH

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Introduction

Himachal Pradesh is situated in the Western Himalayas between 30° 22′ and 33° 12′ N latitude and 75° 45′ and 79° 04′ E longitude. The physiography of the State is predominantly mountaneous with altitude ranging from 250 m to about 7000 m. Such a wide variation in altitude results in marked differences in the climatic conditions met with in different parts of the State. The climatic conditions range from sub-tropical to semi-arctic. Rainfall varies from 0100 mm to 2000 mm. In some parts, it reaches 2,500 mm while in the inner valleys (not within the ambit of summer monsoon) the climate is dry or even arid. The bulk of the precipitation is during summer monsoon lasting from early July to mid September.

The wide range of climate has bestowed the State with a rich and diversified flora ranging from northern tropical to alpine pastures. There are more than 1600 species growing in the State out of which more than 250 species are attributed with medicinal value. Most of these plants either grow wild or occur as weed around habitations and agricultural fields. Among the cultivated plants only *Saussurea lappa* (Kuth) is grown in Lahaul.

Important Medicinal plants of Himachal Pradesh

The number of medicinal plants found in Himachal Pradesh is very large but 19 plants listed below are collected regularly in appreciable quantities and merit scientific study from the point of view of cultivation and collection. The quantities exported through permits issued by the Forest Department are indicated in Table 1. This gives an idea about the quantities which can be available on sustained basis. The figures given are by no means accurate but are only indicative.

There are some drug plants which are collected in bulk only when there is demand.

It is difficult to have an accurate assessment of the quantities which are collected every year. The local residents as right-holders have recorded rights to collect these plants for self use, barter and sale. There are no organised channels for the collection of such plants. These are sold to the petty village shop-keepers who in turn pass to middle-men the material which ultimately finds way in the well established markets at Amritsar and Delhi.

Available resources

No scientific and systematic inventory

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Table 1

Approximate quantities exported

Botanical Name	Common Name	Annual quantity (Qtls) exported from the State during				
		1979-80	1980-81	1981-82	1982-83	1983-84
Dioscorea deltoidea	Dioscorea (Shingli-mingli)	1446	4917	440	990	955
Jurinea macrocephala	Dhoop	3482	4505	4901	6383	5600
Gentiana kurroo	Kaur	1112	1135	804	820	1295
Cinnamomum tamala	Tej Pattar	425	460	328	330	294
Viola spp	Banafsa	95	67	19	10	13
Valeriana wallichii	Mushakbala	1076	1258	2431	3912	1998
Acorus calamus	Barey	317	—	—	—	—
Salvia moorcrofriana	Truth	537	189	227	1216	345
Aconitum heterophyllum	Patish	10	27	26	28	29
A. chasmanthum	Patish Kauri	—	—	2	—	2
Ephedra gerardiana	Ephedra	235	190	83	175	221
Podophyllum emodi	Bankakri	87	35	142	140	72
Angelica glauca	Chora	79	99	237	20	79
Terminalia chebula	Harar	—	160	—	—	—
Pistacia integerrima	Kakar Shingi	—	55	105	130	92
Atropa spp.	Jbarka	—	35	31	6	22
Terminalia belerica	Bahera	—	27	49	—	—
Rheum emodi	Revand Chini	—	12	—	—	135
Carum carvi	Kalazira	—	—	8	20	18

has been prepared about the available resources and their regeneration under natural conditions. The intensity of occurrence varies very widely. Statistical survey based on sampling has not yet been attempted Some sporadic efforts have been made by different institutions on the basis of spot surveys but nobody has attempted to give the actual quantities available which could be collected on sustained basis annually. The notable studies in this regard have been conducted by Shabnam (1964) in Chamba District and Sarin (1967) in Lahaul Spiti District. Teams from F.R.I. Dehra Dun, ICAR, Regional Research Laboratory Jammu, I S M Research Station, Jogindernagar etc. have conducted survey tours to collect information on medicinal plants in different parts of the State. No assessment has been made about the potential productivity in respect of each economically exploitable species.

Steps are needed to regulate exercise of rights in the national interest and to create some nodal agency for the procurement, processing and sale of these plants. Unless the actual collectors of medicinal plants are assured remunerative prices, the quality of the material is not likely to improve.

Cultivation of plants

Sporadic attempts have been made on the cultivation of a few medicinal plants in different parts of Himachal Pradesh. Gupta (1967) conducted some trials on cultivation of *Dioscorea deltoidea* in Chamba District. Department of Forestry of H.P. Agricultural University also conducted trials on the cultivation of *Dioscorea deltoidea*, *Ephedra*, *gerardiana*, *Podophyllum emodi*, *Mentha* spp., *Artemisia maritima* etc. Trials on the cultivation of *Dioscorea* have also been conducted by the Himachal Pradesh Forest Department and Wyeth Laboratories, Bombay. Commercial cultivation of *Saussurea lappa* (Kuth) and *Humulus lupulus* (Hops) is being done in tribal areas of the State.

The results of such trials have not been brought to conclusion and no standard package of practices has been made available on a large scale. The attempts have, therefore been half hearted without scientific and financial support.

Dioscorea deltoidea is one of the most important medicinal plants which is much in demand. An attempt has been made by the Himachal Pradesh Forest Department to introduce this species in the plantations of Deodar, Fir and Spruce in a systematic manner by dibbling pieces of tubers weighing 50 to 100 g. The results have been very encouraging in case of experiments carried out in Kullu in Sundernagar Forest Divisions. The studies indicate that it takes more than 10 years for such tubers to develop into exploitable size yielding about 500 grams worth of wet material. Therefore, further propagation trials may be conducted to improve the yield.

Presently lot of efforts are put in for locating these plants and extracting them. No sign for the occurrence of such plants has been noticed in nature as the habitats where such plants occur are highly variable.

Economics of introduction of *Dioscorea*

Some sporadic attempts on cultivation of different species were made in the past.

Large area for such cultivation are not available to make such ventures economically viable.

In Kullu and Sundernagar Division, introduction of *Dioscorea deltoidea* was done in the area taken up for plantation of Deodar, Fir and Spruce. Green tubers pecies weighing about 75 gm each were dibbled in the pits where main forest species were planted. The main plant gives support to the plant of *Dioscorea deltoidea* and thus assures the availability of the tubers commercially from concentrated areas. Plantation areas were made approachable and well protected. The collection charges were minimized in view of adequate quantities available from limited areas.

The expenditure incurred is by way of collection of the planting material in the form of tubers of *Dioscorea deltoidea* and dibbling the same into the pits already dug out. The cost comes about Rs. 400/- per ha; Rs. 200/- being the cost of the collection of one qtl of tubers and Rs. 200/- per ha of planting.

The sale rate of green tubers in the forest varies from Rs. 2 to Rs. 3 per kg depending upon location and atleast 1.5 MT of green tubers can be harvested after 7-10 years.

Collection

As already stated, the work of collection of medicinal plants is done by local residents in exercise of their recorded rights. The local people are quite proficient in identifying, locating and collecting such plants. This work is done by them in their spare time.

They have not been trained about the optimum time when such plants should be collected. They go by their own experience based on long periods of observation and collect the plants when they consider the yield to be maximum.

Yield

No attention is being paid about the future regeneration of the species. In many cases the entire, tuber or root is grubbed out amounting to 'mining' of the resource. By proper training based on actual research, the quantities which have to be extracted from each site/plant, can be specified so that sustained availability is assured and future of the species is not endangered.

Processing

Wet material collected from the forests is brought by local people to their houses and stored either in the open or in dark ill-ventilated rooms. Most of the material collected invariably gets infested with insects, fungi etc.

No attention is being paid to the time of collection when such plants should be best collected. However, it is known that any material collected during periods of high humidity, will take long time to dry and will be prone to attack by organisms.

Break up of the material into suitable sizes is a necessary pre-requisite to ensure proper drying and grading. No material is stored or transported in the wet condition. With the advent of solar kilns drying could be highly improved and made a very quick process. The temperatures and the period at which drying has to be done have not been standardised for any species.

Packing of the material is also not done in a scientific manner. Worn out and infected gunny bags are used for the purpose. No satisfactory arrangements for the transport of the material are made. The bags of such material lie in the open for many days and deteriorate as exposure of the product to nature after drying leads to loss of alkaloid contents.

Marketing

Many attempts have been made to regulate marketing through Co-operative Societies or other similar agencies. These attempts have not yielded satisfactory results. Petty village shop-keepers and middle-men are controlling the trade without applying their mind to the quality of the material handled by them. They are guided only by bulk supply.

Genetic studies

The species occurs over a wide range and alkaloid content varies very widely both due to genetical and environmental factors. The contribution made by the two factors has not yet been evaluated. It will be necessary to identify genetically superior strains for propagation. In case of *Dioscorea*, it has been found that Jogindernagar Valley of Mandi District contains upto 6% of the *Diosgenin* while in samples collected from parts of Kinnaur and Kullu, it would be as low as 1%.

Future line of action

Following future line of actions are proposed :

(i) The species which should be taken up for studies should be identified. It is not possible to take up this work for all the species occurring naturally. It is suggested that *Dioscorea deltoidea*, *Jurinea macrocephala*, *Berberis* spp , *Viola* spp. and *Podophyllum emodi* may be taken in the first instance. With the experience gained with these species the list can be further increased.

(ii) Scientific survey of the species growing in different parts has to be carried out. Approach should be to take one district and with the help of local people, identify the pockets where a particular species occurs. The survey should aim at both quantity and quality in respect of the useable portions.

(iii) The survey should also identify the zone of occurrence and the properties with respect to the quantum of useable ingredients should also be specified.

(iv) ISI specifications have to be laid down in respect of following items :

(a) Time of collection for each species.

(b) The shape and form in which the material has to be made available for marketing.

(c) Method of drying specifying the temperature and humidity.

(d) Packing of the collected material. Whether the packing is to be done in gunny bags. plastic bag, or tins etc. All details of operations for pre and post harvesting have to be laid down.

(e) In order to preserve germplasm of various plants, gene pool reserves of all valuable and useful drug plants need to be preserved in the nurseries.

(f) Genetic studies have to be carried

out as a separate item and propagation of genetically superior strains has to be taken up.

(h) The present methods of extraction/collection of such plants have to be standardised so that the available resources are not mined out and attention is paid to their future propagation and development.

Conclusions

Much has been expressed about the dwindling resources in respect of medicinal plants in the Himalayas. Many seminars and meetings have been held but suitable action has not been proposed. If medicinal plants are not protected and scientifically exploited, it may be completely depleted posing serious ecological and economical threats. It is high time that a proper programme to assess the present situation on the basis of detailed surveys is drawn up and simultaneously future line of action is laid down. Goverment has to come in a big way to end the exploitation of the local people. Their existing rights may be acquired by paying suitable compensation. They may, however, can be allowed to extract the plants required for their bonafide domestic use.

SUMMARY

An attempt has been made to describe the present state of affairs with respect to the exploitation of medicinal plants in Himachal Pradesh. A case has been made out for standardizing package of practices for the collection, processing, marketing etc. of the important medicinal plants. Suggestions for taking up cultivation in forest areas and popularization of high yielding strains by carrying out genetic study has been made.

हिमाचल प्रदेश में औषध–पौधों की खेती और सग्रह करने की वर्तमान स्थिति और भविष्य की संभावनाएं

एम०पी० गुप्त

सारांश

इस अभिपत्र में हिमाचल प्रदेश में औषध-पौधों के समुपयोजन की वर्तमान स्थिति को वर्णित करने का प्रयास किया गया है। महत्वपूर्ण औषधियों के सग्रह, विधायन आदि प्रथाओं को एक साथ लेकर प्रतिमानित करने की आवश्यकता समझाई गई है। वन क्षेत्रों में उनकी खेती कराने और अधिक उत्पादन देने वाले बीजों को लोकप्रिय बनाने के लिए उनके जननिक अध्ययन कराने के सुझाव दिए गए हैं।

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SEM STUDIES ON MONO-, DI-, AND POLYSACCHARIDES

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Introduction

Besides biological complex polysaccharides, heterogeneous polysaccharides like gums and mucilages have very important role to play in human life. Many gums are being used in food industries for different preparations, but their shortages, however, prompt adulteration with inferior gums. It is proposed to use Scanning Electron Microscope (SEM) for the identification of gums. Overall molecular structure of polysaccharide depends on the presence of constituent monosugars, nature of linkages and its configuration. A novel method of application of the SEM in the study of sugars is introduced for the first time (Soni and Bisen, 1984). These studies revealed distinct crystalline morphology of monosaccharides, disaccharides and polysaccharides when observed under SEM. Earlier electron diffraction technique have been used to observe the crystallization behaviour of Glucomannan (Chanzy *et al.*, 1982). In this paper we have observed nine monosaccharides, three disaccharides and two natural gums from *Acacia catechu* Benth (exudates) and *Prosopis chilensis* Stuntz (Syn. *P. juliflora* (Swartz) DC) seed polysaccharides for their identification.

Materials and Methods

Crystals of pure monosugars were mounted on the specimen stub using double coated sticking tape. They were first coated with carbon followed by gold/palladium using Edwards-306 vacuum coater. Observations were made by Cambridge Stereoscan S-600 scanning electron Microscope.

Results

Crystalline morphology of pure monosaccharides and disaccharides as observed are described below :

D-Glucose : The crystals are basically orthorhombic and micaceous (foliaceous crystals) (Fig. 1).

D-Mannose : Coralloidal when observed under low magnification, an individual crystal at higher magnification is rhomboidal and tend to constellate (Fig. 2).

D-Galactose : Crystals are triangular (orthorhombic) twins striated surface (Fig. 3).

L-Rhamnose : Crystals vary in their shape depending upon their lying position. An individual crystal when observed under high magnification is typically prismatic (hexagonal). On the surface of hexagon many small crystals of varying shape are discernible (Fig. 4).

D-Fructose : It is characterised by twinned squarish/cubic form of the crystals. (Fig. 5).

L-Arabinose : It exhibits flattened rod like shape of the crystal (Fig. 6).

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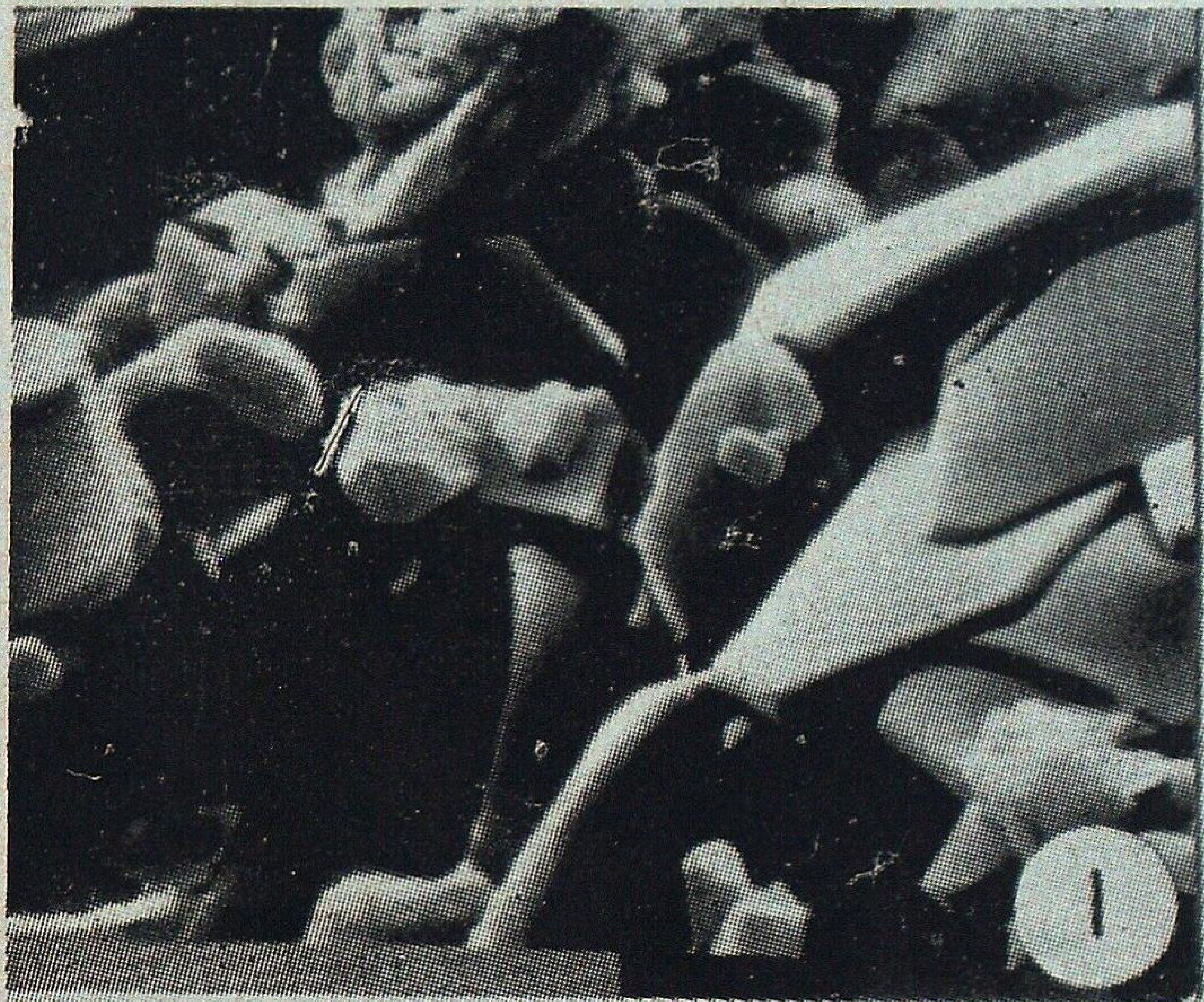
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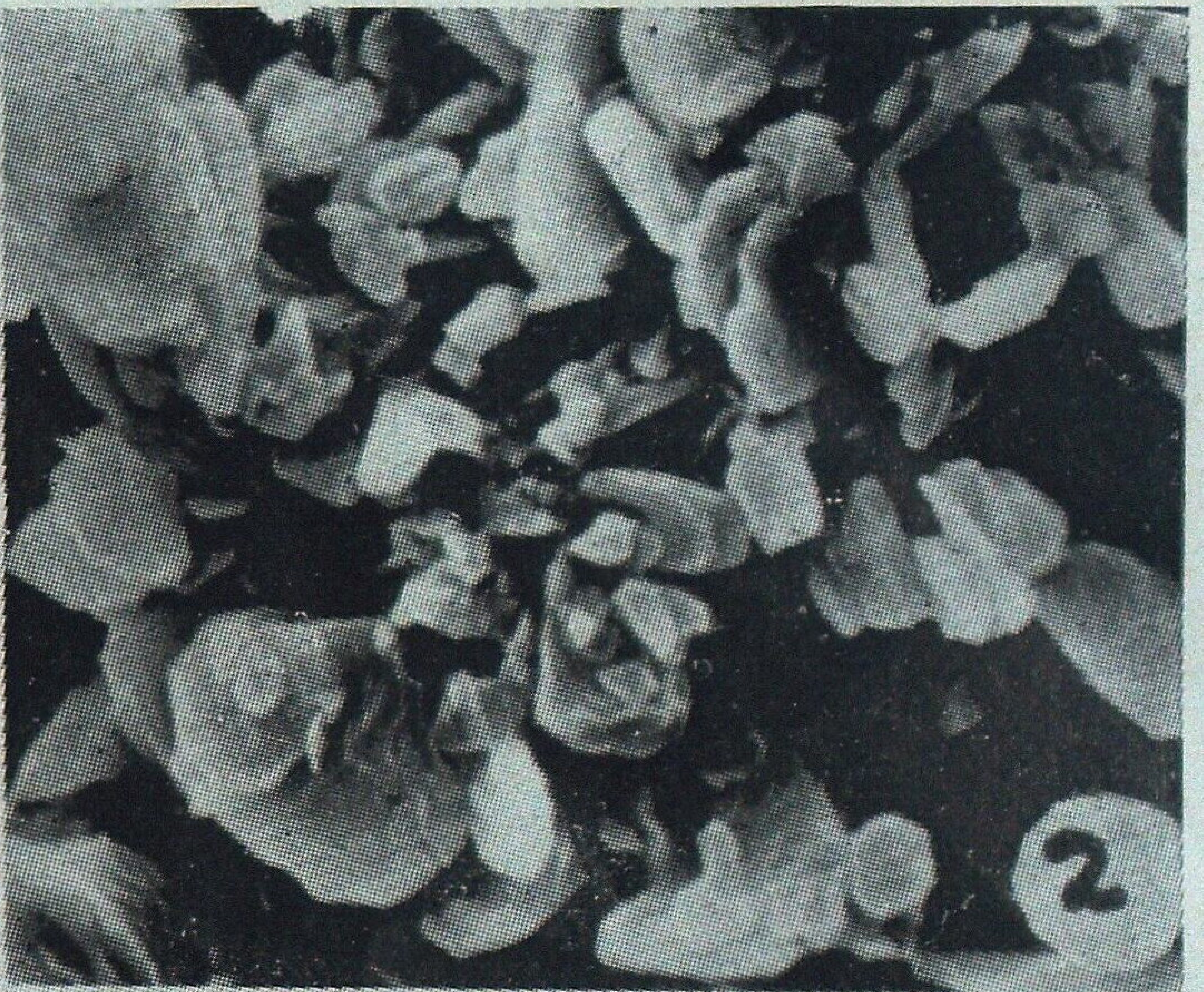
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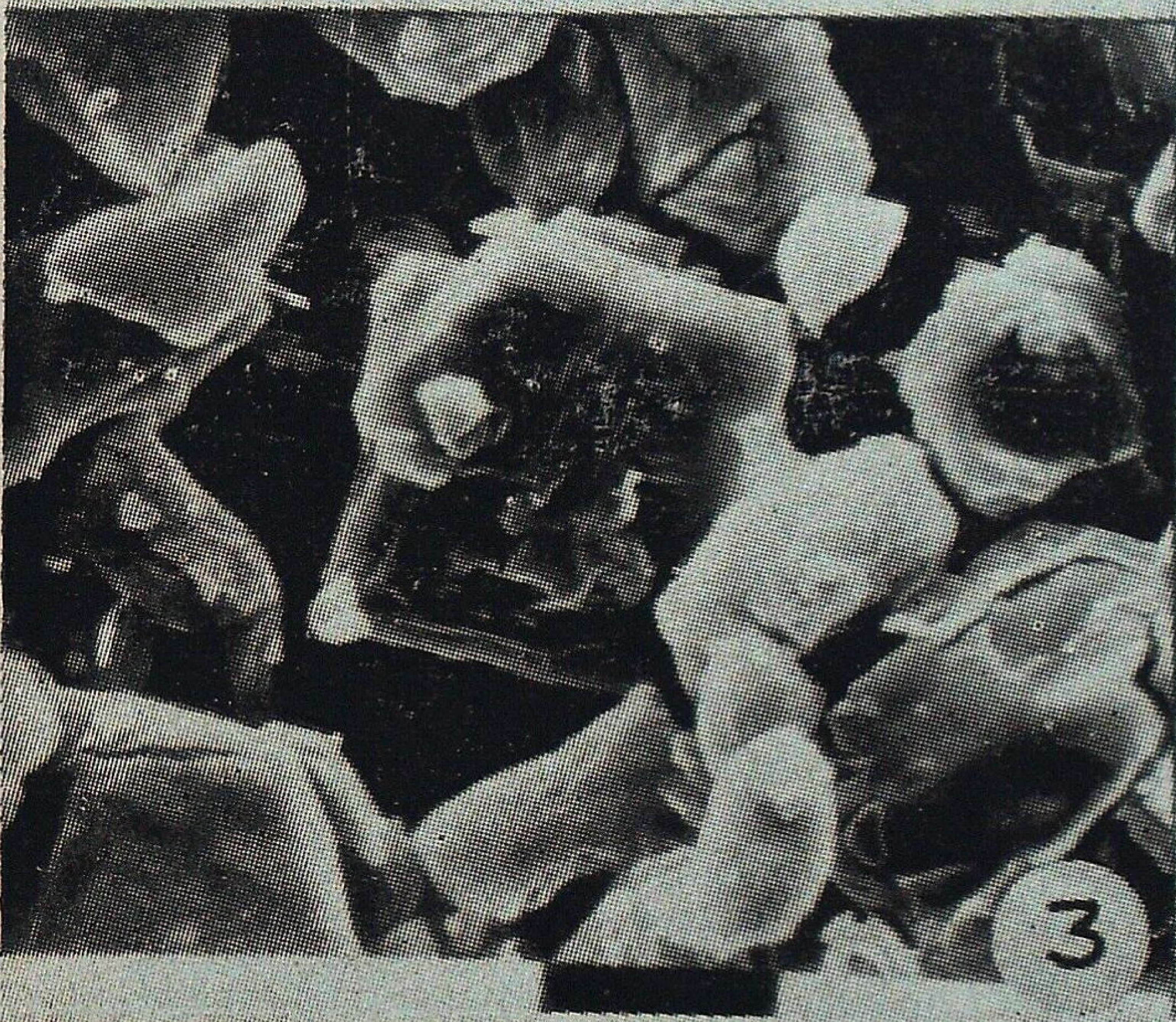
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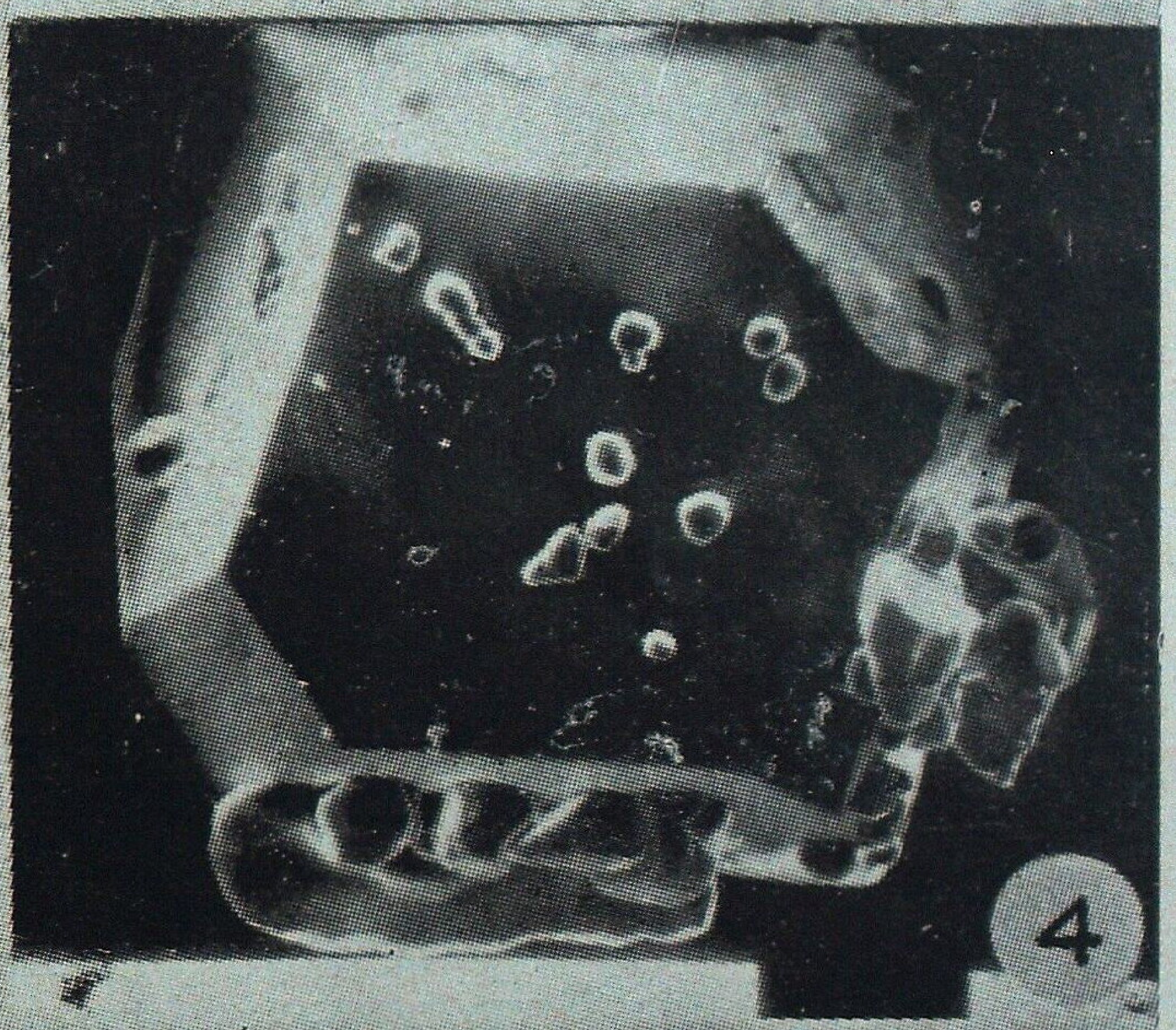
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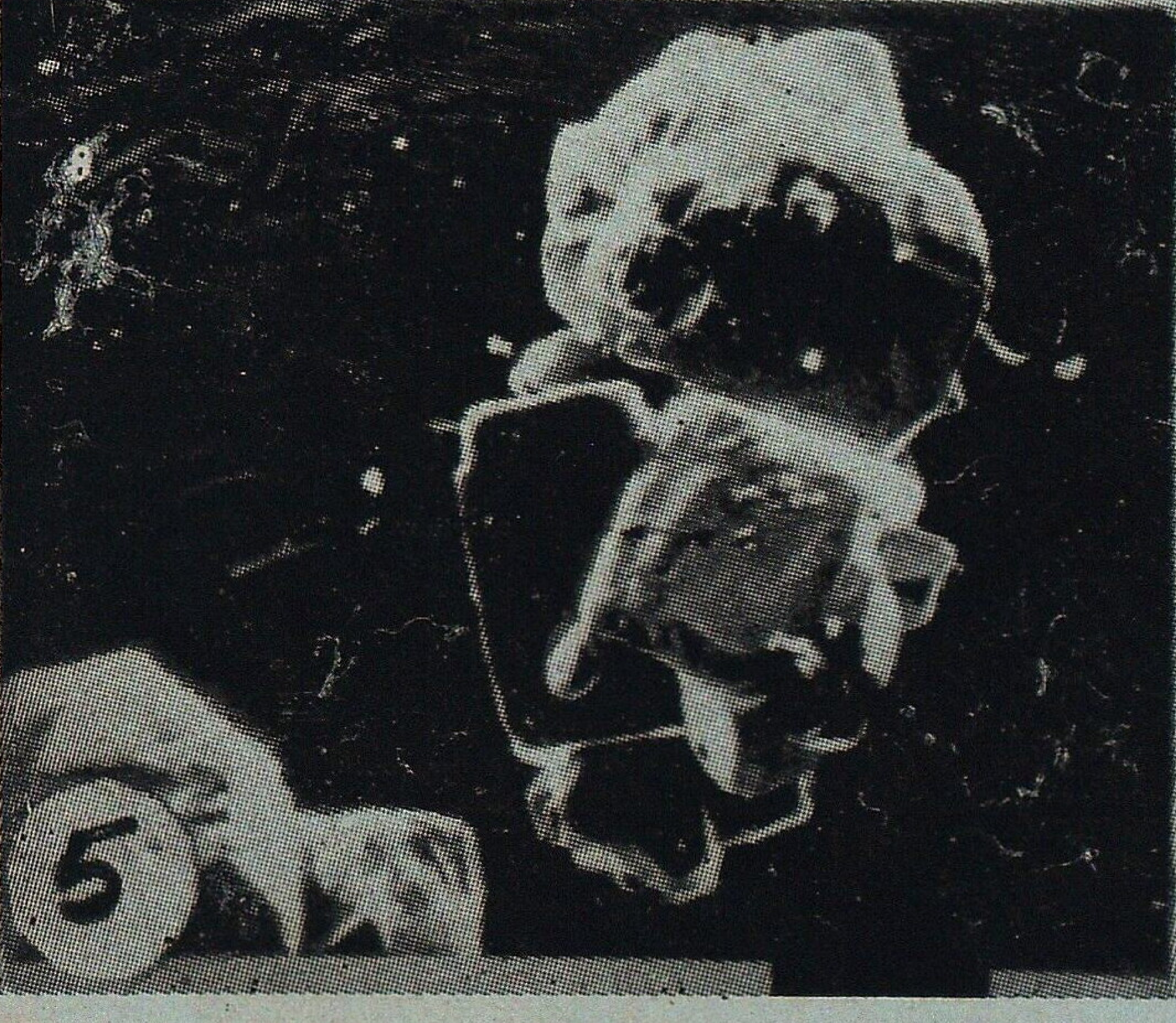
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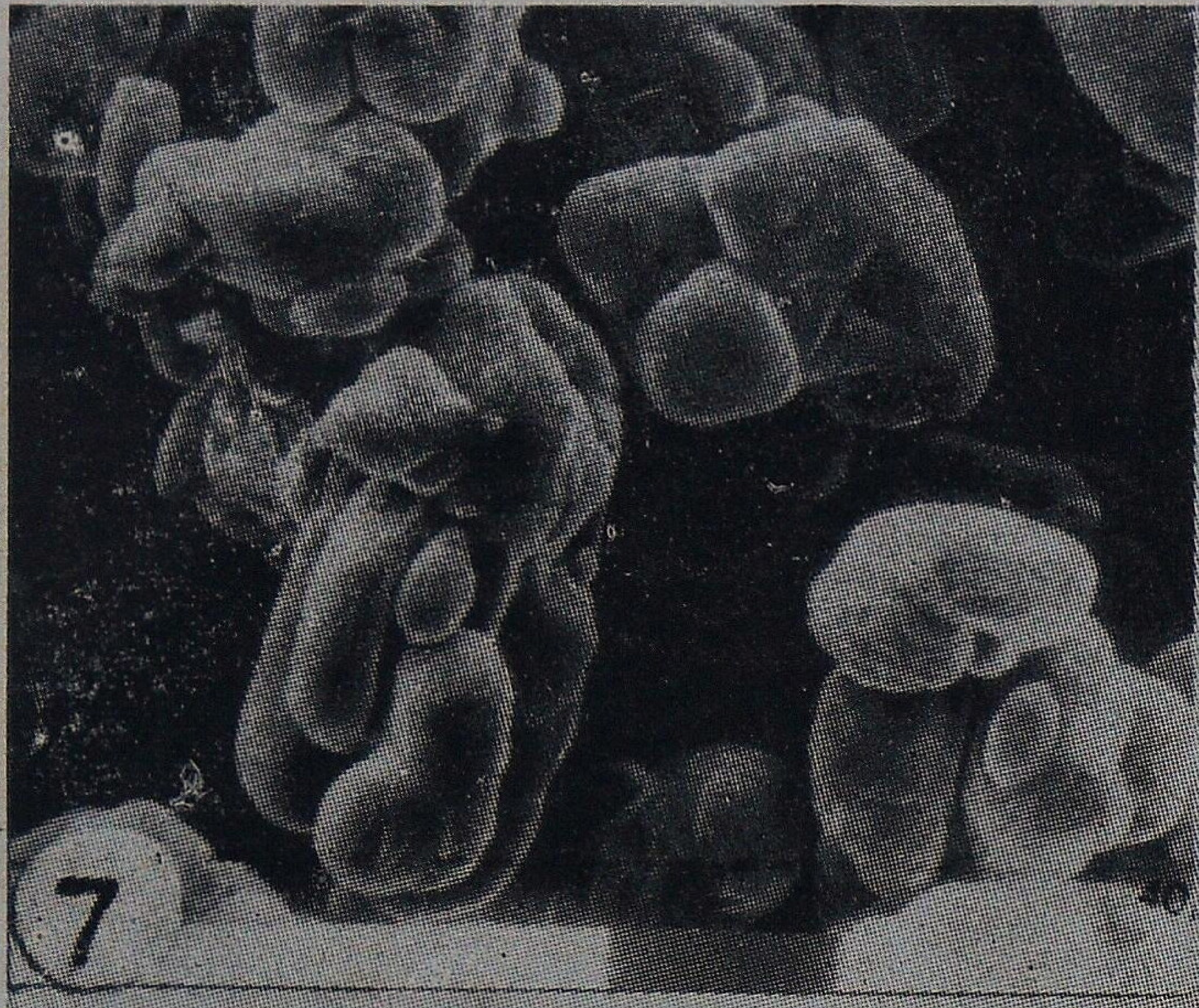

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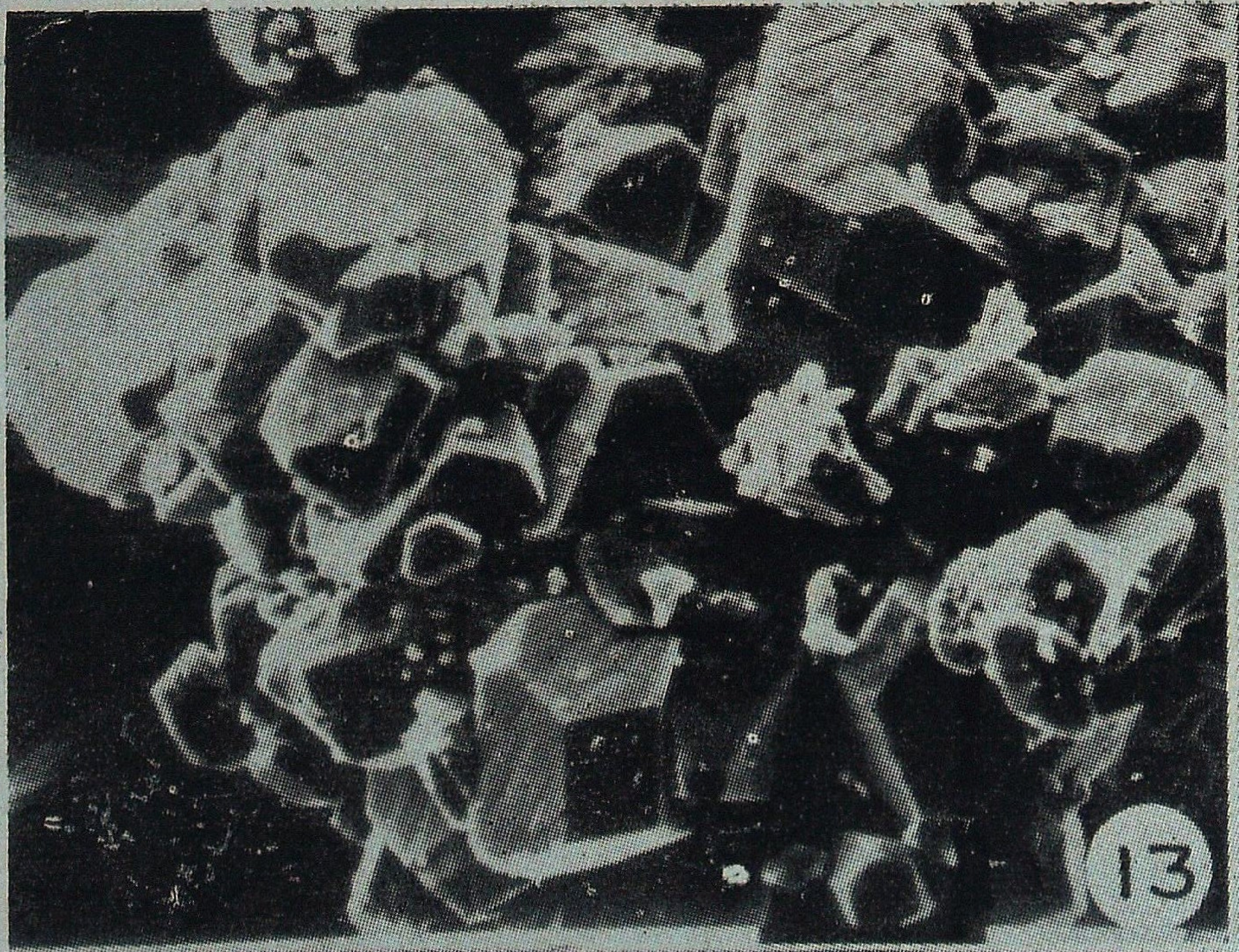
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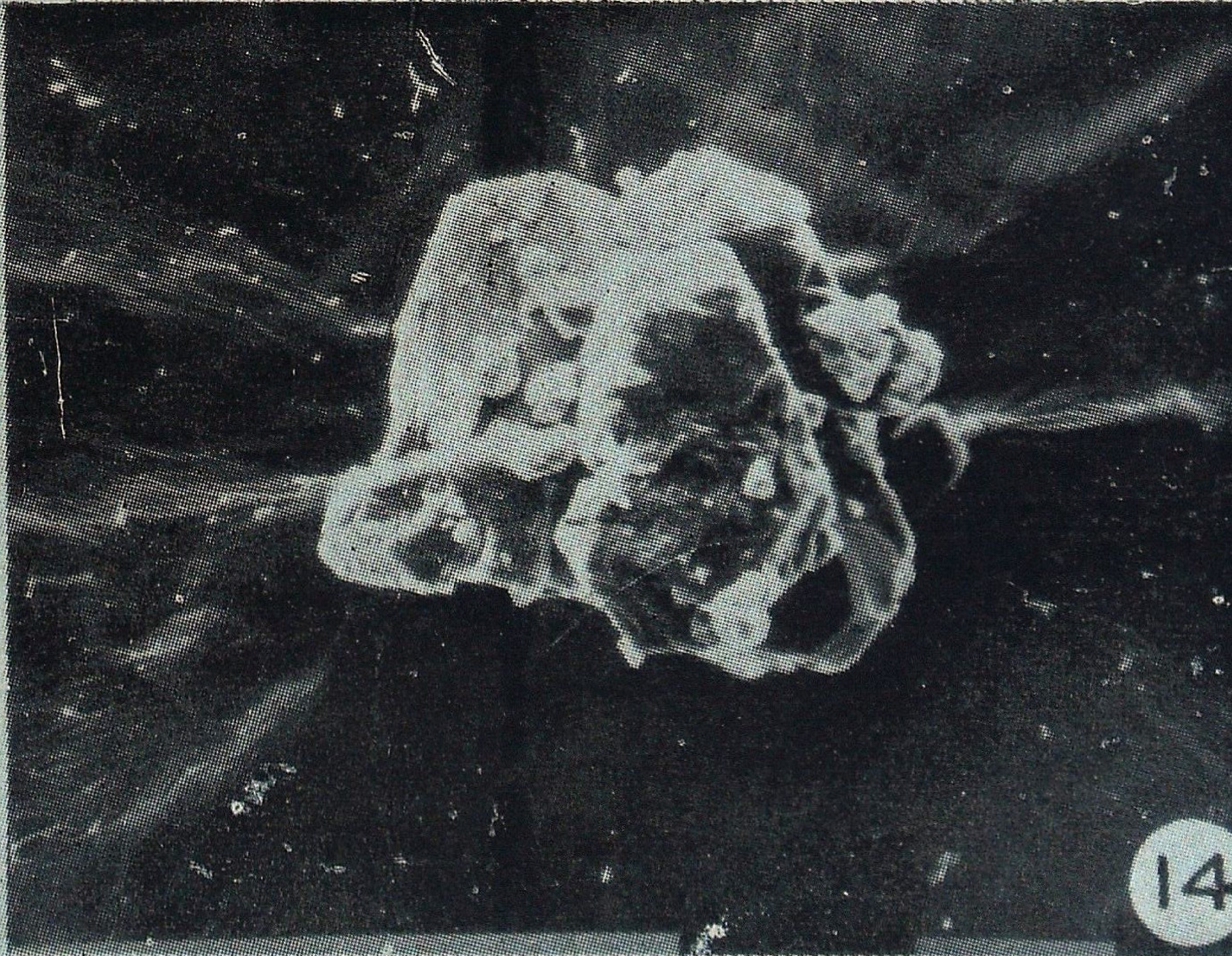
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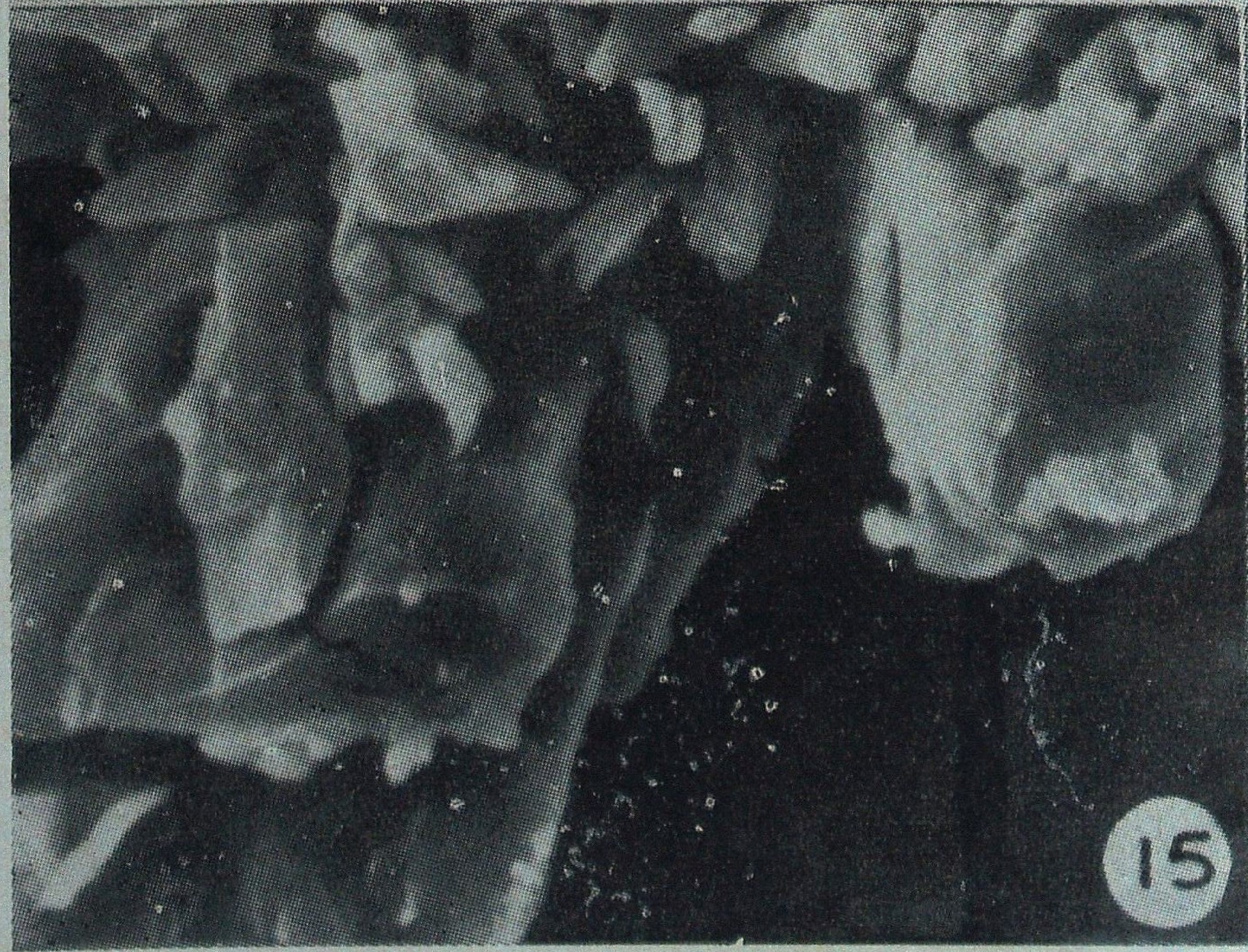
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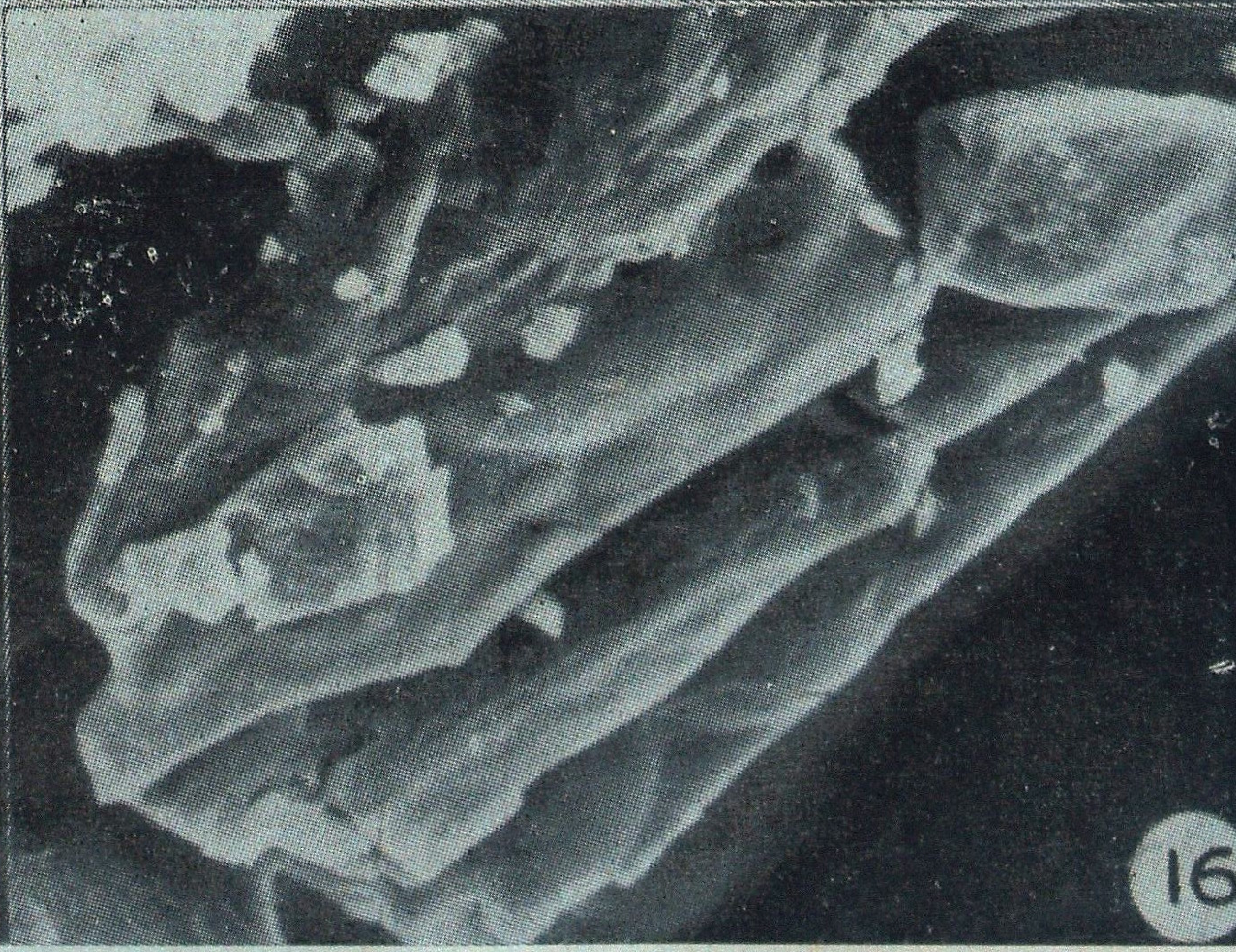
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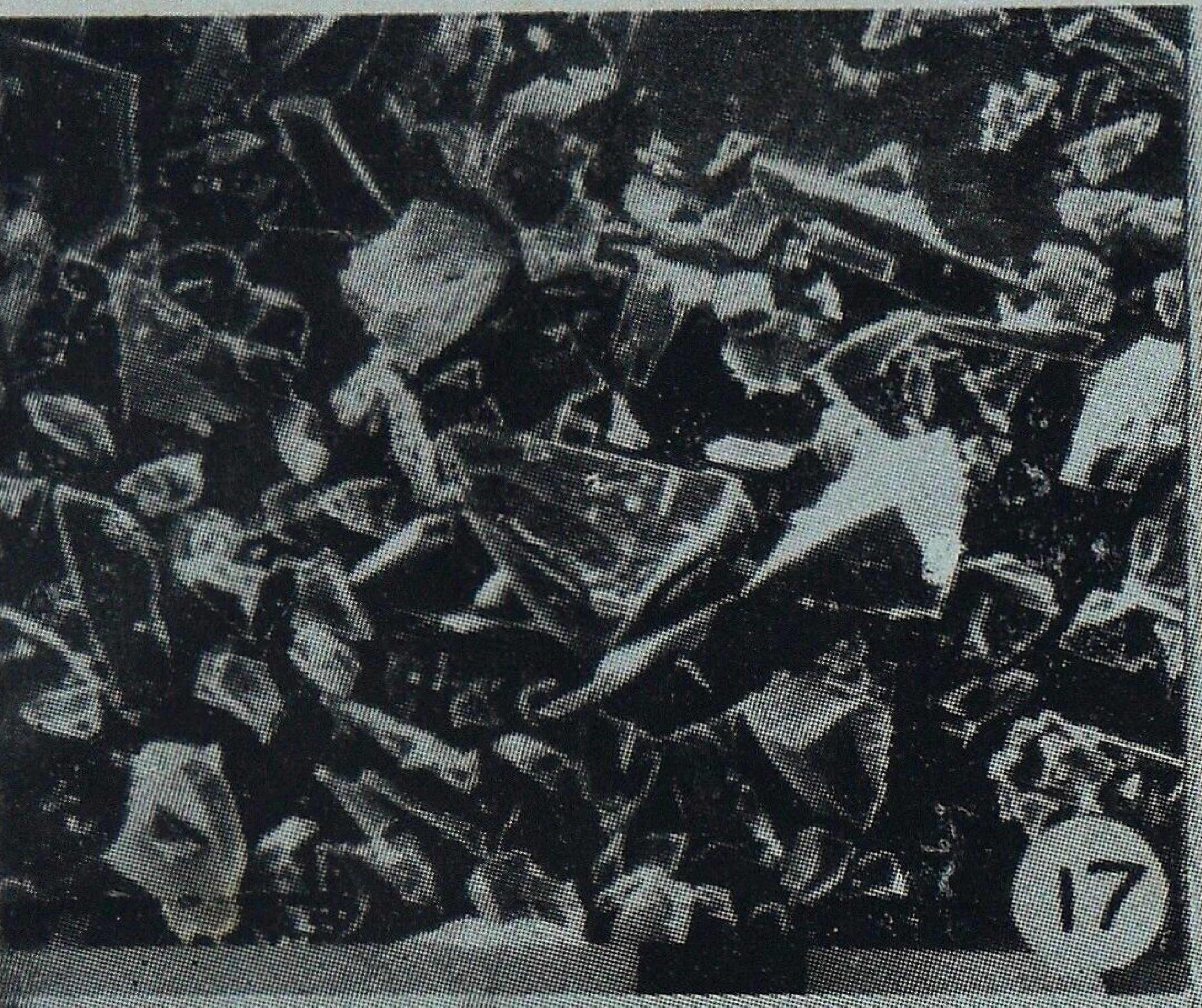
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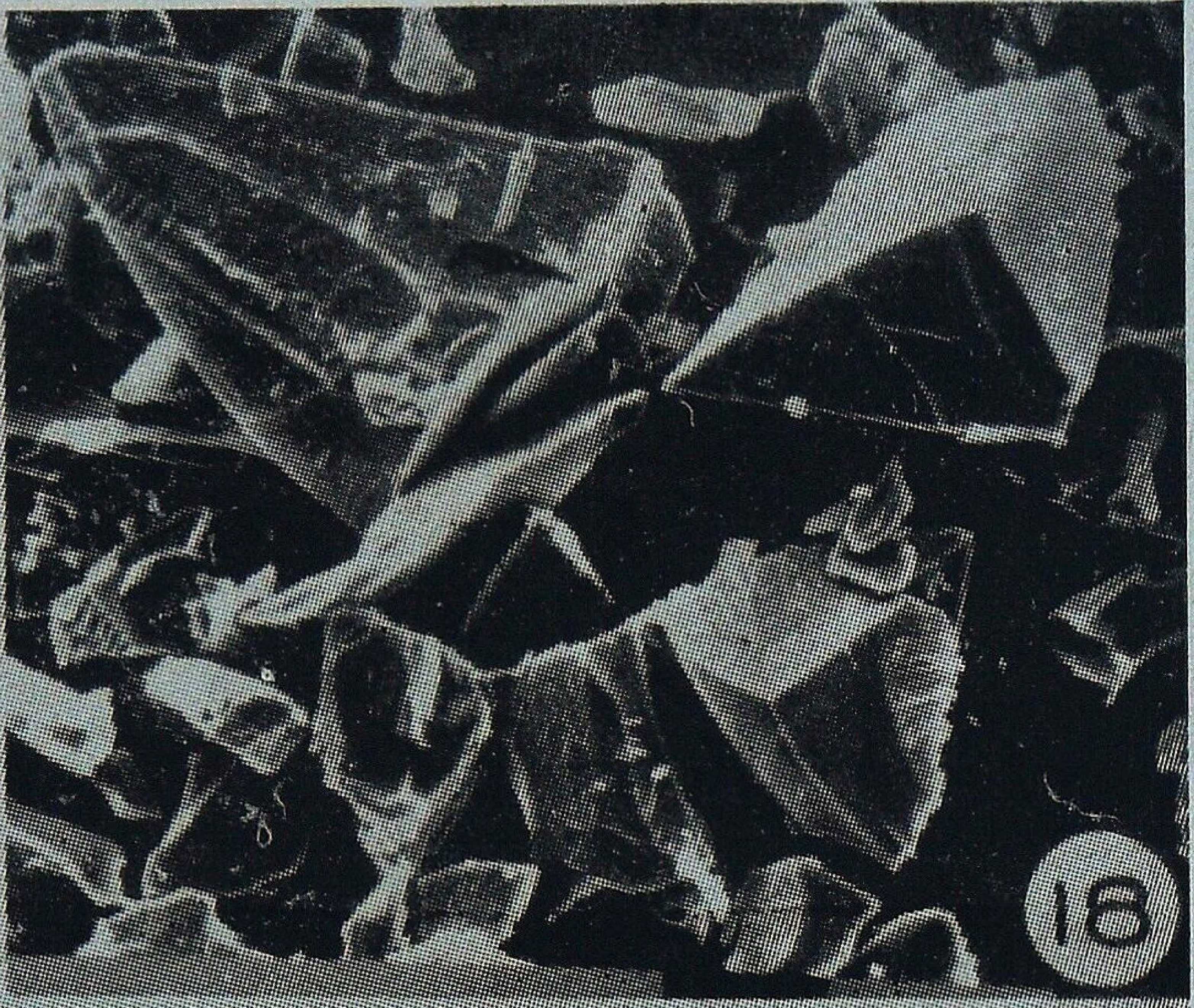
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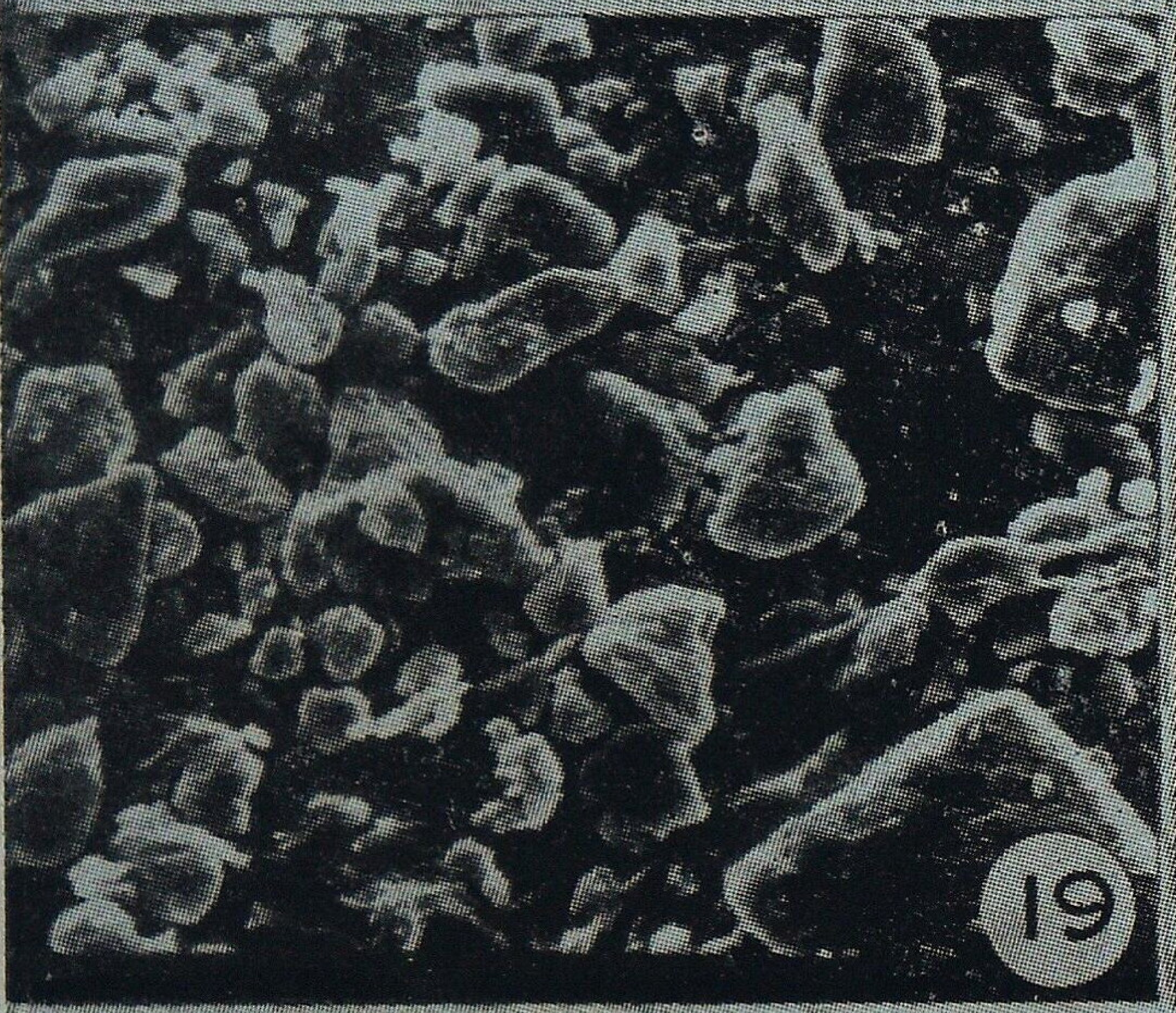
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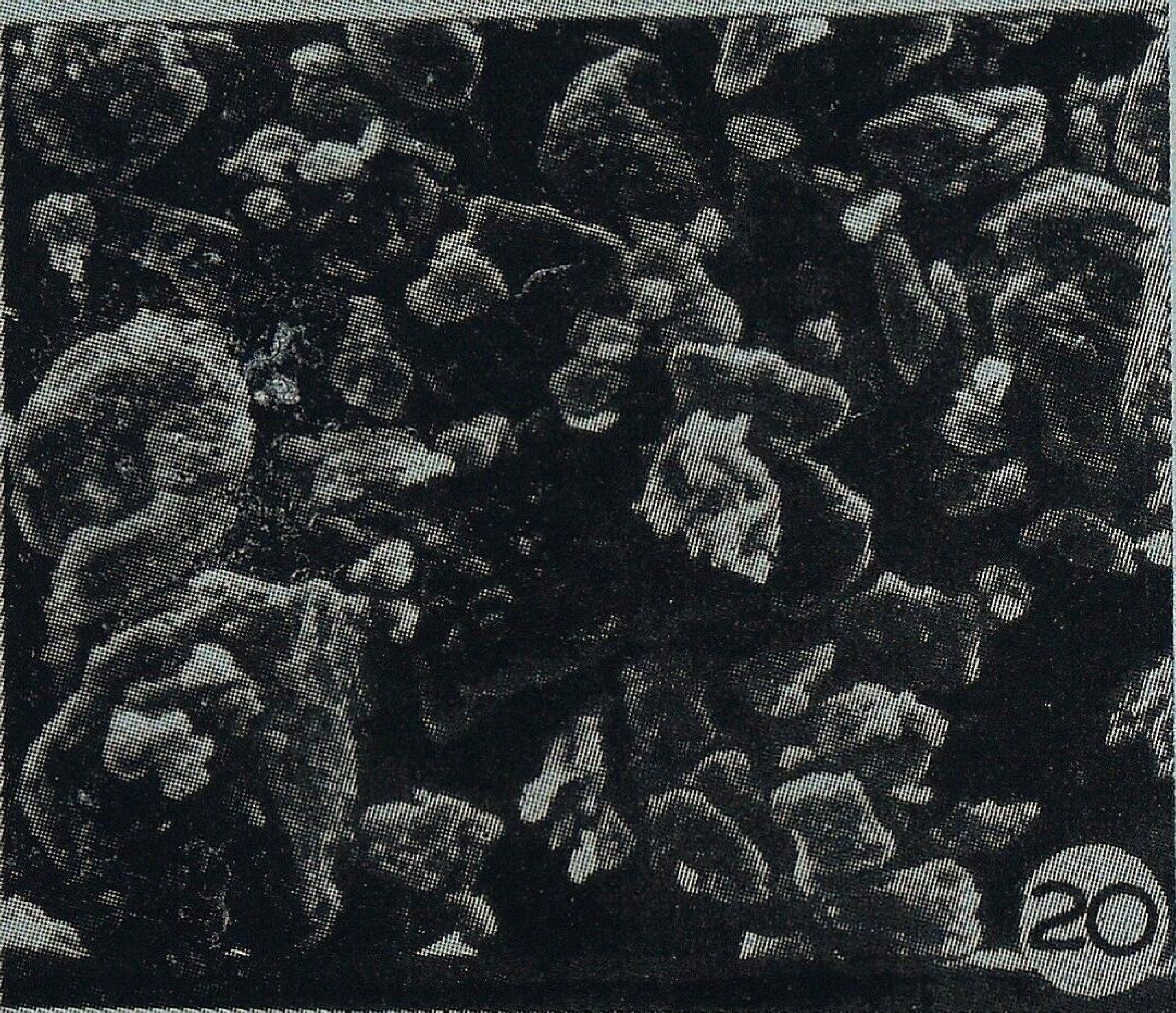
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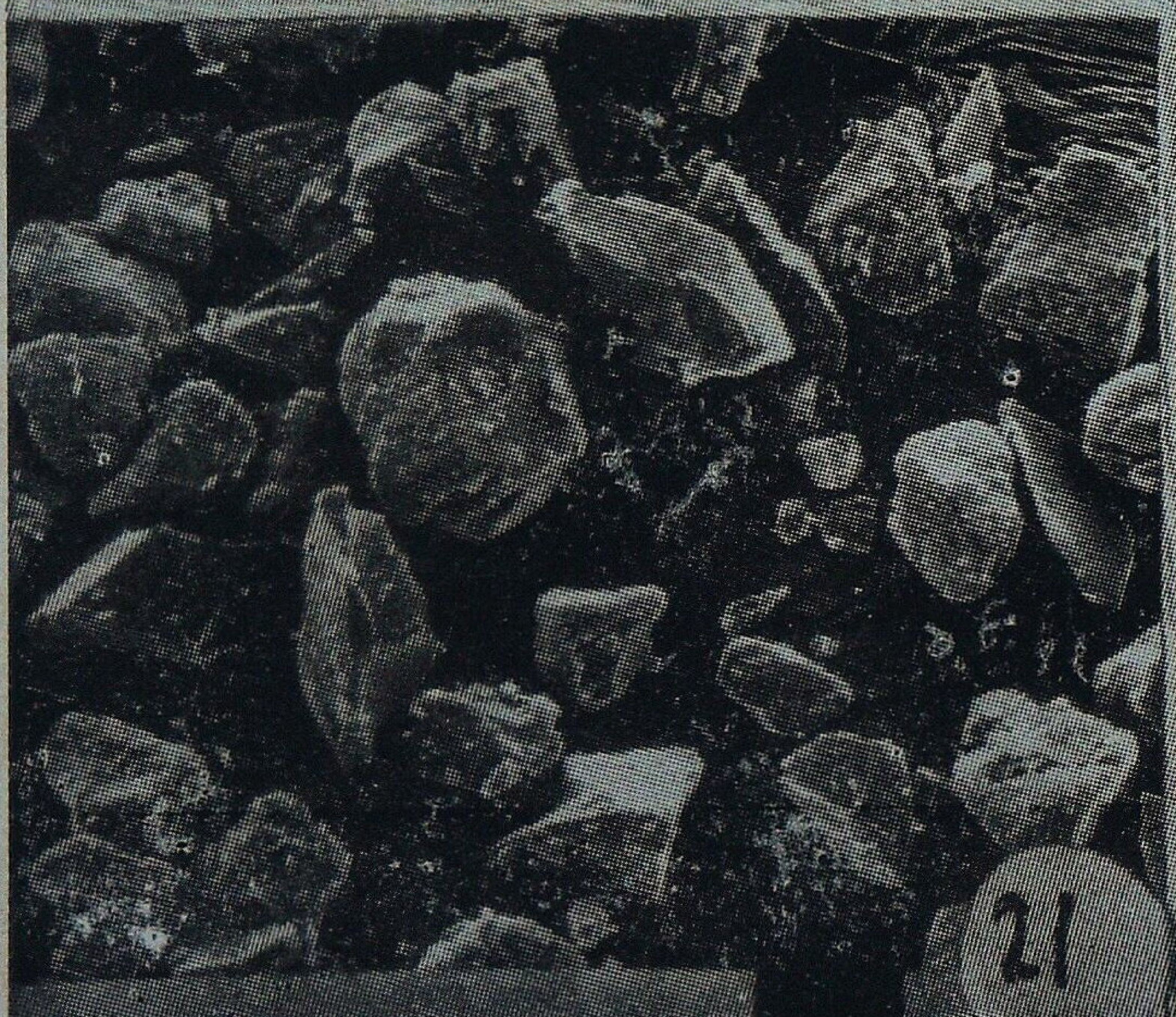
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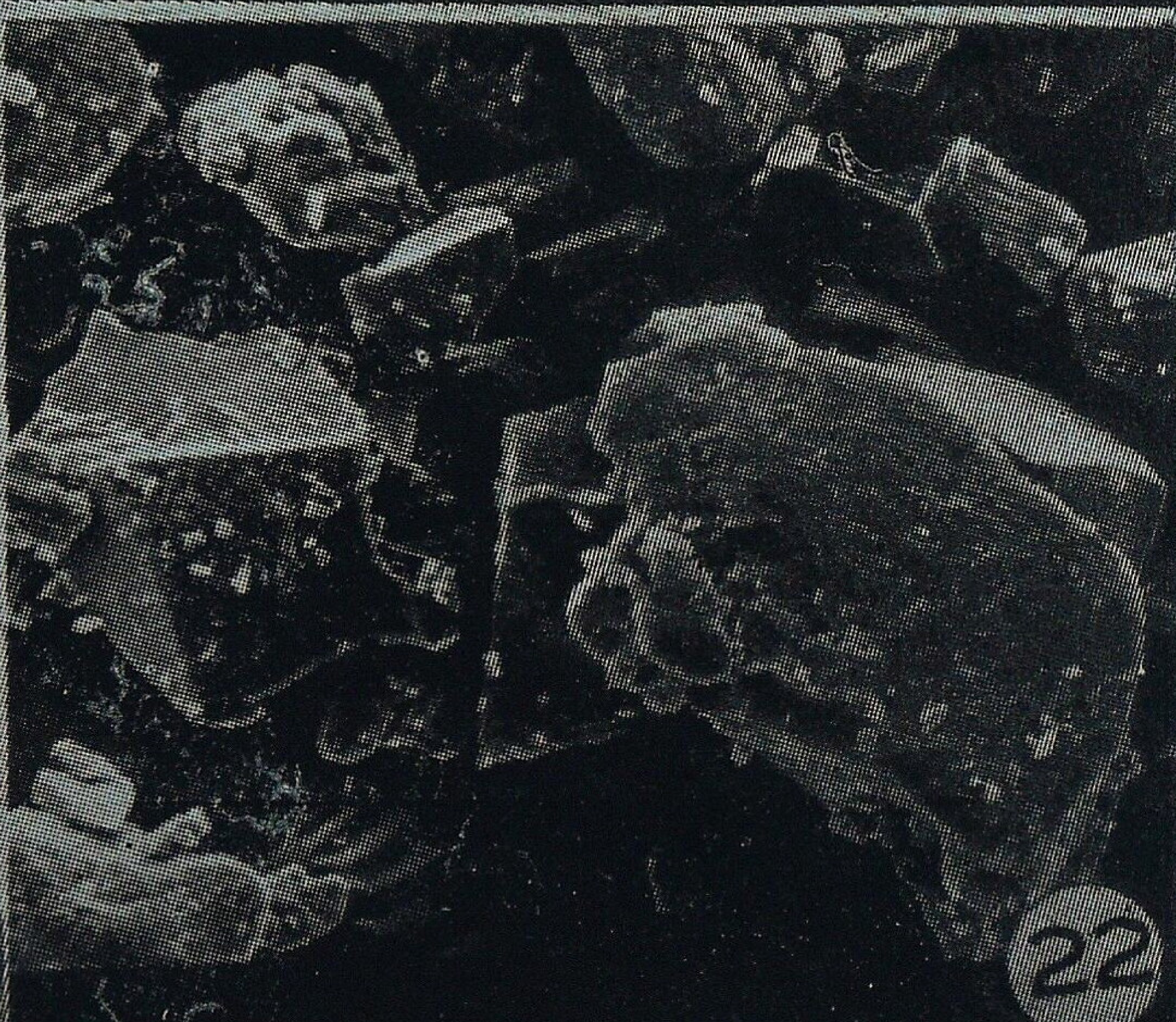
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D-Xylose : Crystals are in reniform (kidney shape), lying in bundles, having smooth or fissured surface (Fig. 7).

D-Glucuronic acid : Crystals are acicular in the form of bundles and also have a tendency to form irregular reticulate aggregate (Fig. 8).

D-Galacturonic acid : Crystals are rod like with pendants and have tendency to form clusters (Fig. 9, 10).

Cellobiose : Crystals are linked glucose–glucose, have orthorhomboidal-micaceous flakes shape (Fig. 11, 12),

Melibiose : Crystals are linked galactose-glucose, shows orthorhombic—triangular twins shape (Fig. 13, 14).

Sucrose : Crystals are linked glucose-fructose, have orthorhombic-twinned squarish cubic shape (Fig. 15, 16).

Gums : Gum of *Acacia catechu* and *Prosopis juliflora* seed polysaccharide have their distinct morphology. The gum of *A. catechu* shows predominantly the presence of typical crystals of galactose & arabinose (Fig. 18) with its characteristic morphology (Fig. 17). GLC of the alditol acetates of gum hydrolysate also support the galactoaraban nature of the gum.

P. juliflora seed polysaccharide has its own morphology different from *A. catechu* gum. Galactomannan nature of seed polysaccharide (Fig. 20) with its distinct morphology (Fig. 19) gets support from GLC of alditol acetates of hydrolysate.

Morphology of the mixture of the above two gums (Fig. 21 & 22) indicate even after thorough mixing with each other the individual gum retains its own characteristic morphological pattern.

Discussion

From the results it is evident that all the monosaccharides have their own 3-D morphological identity which facilitates easy recognization. Thus glucose can easily be distinguished from others by its micaceous nature of crystals having orthorhombic shape while mannose is rhomboidal and tend to constellate. Similarly D-galactose has the shape of twin triangular crystals with striations while D-fructose has twinned squarish cubic form of crystals without striations. D-xylose is unique in having kidney shaped crystals whilst L-arabinose evinced flattened red like crystals. Prismatic hexagonal crystal containing small crystals of varying shape on their surface is indicative of the L-rhamnose.

Furthermore, the consistency by which these monosaccharides exhibited their crystalline morphology can also be corroborated by studying the disaccharides. Thus, cellobiose (glucose $1 \xrightarrow{\beta} 4$ glucose) showed micaceous, orthorhombic crystals superimposed one over the other. Similarly, mellibiose (galactose $1 \xrightarrow{\beta} 6$ glucose) exhibited coalescence of orthorhombic triangular twins. Sucrose (glucose $1 \xrightarrow{\alpha/\beta} 2$ fructose) displayed orthorhombic–squarish cubic form of crystals. Studies of two acids also revealed their distinct morphology. While crystals of D–galacturonic acid are rod like with pendants and with a tendency to form clusters, D-glucuronic acid crystals has acicular shape and occur in the form of bundles.

Characteristic crystalline nature of mono- and disaccharides prompted us to study the morphology of gums in order to get their quick identification as till todate no other physical method is available Adulteration of gums is quite prevalent and chemical methods to detect adulteration are very tedious and time consuming. Scanning electron microscopic observations of exuded gum (Fig. 17, 18) and seed gum (Fig. 19, 20) reveal that these natural polymers have their own characteristic morphology which can be disturbed by adulteration as shown by mixing the above two gums (Fig. 21,22).

It is evident from the above account that SEM can be exploited as a useful tool in the identification of natural polymers like gums and mucilages. Further work on the identification of gums is in progress.

Acknowledgement

Authors wish to express their thanks to Dr. K S Ayyar, Officer-in-Charge, Chemistry of Forest Products Branch and Dr. R V. Rao, Research Officer, Wood Anatomy Branch, for their suggestions and keen interest in this work.

SUMMARY

Naturally exuded gums are in use in different food preparations. Gums are natural polymers of monosugars. SEM studies of nine monosaccharides, three disaccharides and two gum polysaccharides were undertaken to determine their morphology. Monosaccharides and disaccharides exhibited their distinct crystalline morphology. Naturally exuded *Acacia catechu* gum and *Prosopis juliflora* seed polysaccharides also indicated characteristic morphology.

एक, द्विव और बहुशर्करेयों का सेम अध्ययन

पी०एल० सोनी व एस०एस० बिसेन

सारांश

स्वभावत: निष्यन्दित होने वाले गोंद अनेक भोजन बनाने में उपयोग किये जाते हैं। गोंद एकशर्करेयों के प्राकृतिक पुरुभाज होते हैं। नौ एकशर्करेयों, तीन द्विवशर्करेयों और दो खोंद बहुशर्करेयों का सेम अध्ययन उनकी रचनाकारिकी ज्ञात करने के लिये किया गया। एकशर्करेयों और द्विवशर्करेयों से उनकी स्पष्ट स्फट बनाने की रचनाकारिकी दिखाई पड़ी। अकेसिया केटेच्यु के स्वभावत: निष्यन्दित गोंद और प्रोसोपिस जुलीफ्लोरा के बीजों के बहुशर्करेयों में भी एक विशिष्ट प्रकार की रचना दिखाई देती है।

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EFFICACY OF SOME INSECTICIDES AGAINST THE LARVAE OF KHASI PINE SHOOT BORER, *DIORYCTRIA CASTANEA* BRADLEY (LEPIDOPTERA : PYRALIDAE)

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Introduction

In 1982, Chief Conservator of Forests, Arunachal Pradesh, sent an SOS to President, Forest Research Institute and Colleges, Dehra Dun reporting an insect epidemic in Khasi pine, *Pinus kesiya* plantations at Yachuli, in Hapoli Forest Division and asked for control of the pest. Authors visited the affected plantations in August, 1982. The insect causing damage was a shoot borer. All age groups of Khasi pine were attacked and incidence of attack was 100 per cent. There were *ca.* 900 hectares of Khasi pine plantations. Small areas planted with *P. patula* and *P. wallichiana*, escaped the shoot borer attack. Khasi pine plantations gave the look of a fire burnt forest. The dead shoots with tunnels were empty except that some dead larvae and empty pupal skins were found from which it could be said that some species of genus *Dioryctria* Zeller was/were responsible for the damage. Khasi pine is not indigenous to the area. Four species of genus *Dioryctria* viz., *D. abietella* Denis and Schiffermueller, *D. assamensis* Mutuura, *D sylvestrella* Ratzburg and *D. castanea* Bradley have been reported boring shoots of *P. kesiya* in Meghalaya (Bradley, 1969; Mutuura, 1971; Chacko, 979; Singh, *et al.*, 1982). From rearing of the shoot borer to adults in 1983 identity of the pest was established. The shoot borer of Yachuli plantations was identified as *D castanea* Bradley described by Bradley, in 1969.

Larva of the moth *D. castanea* a shoot borer of Khasi pine has been so far reported only from Meghalaya. Its presence in Yachuli, Arunachal Pradesh, is the first record of its occurrence outside Meghalaya from where there is no report of an epidemic build up of the species. The adult moth is an average sized *Dioryctria* with typical forewing pattern, reddish chestnut brown in colouration, its forewings are smooth scaled, ground colour varying from purplish to chestnut brown, irregularly irrorate with silvery or white tipped grey scales, the hind wings are smoky grey and bear pale golden scales and grey cilia and with a wing expanse of 22–27 mm. Both sexes are alike in colouration and wing pattern. Eggs are laid on the young fleshy male cones, shoots and needles of Khasi pine in the last week of February. Eggs are some what oval, 0.8 mm – 1 mm long, cream coloured with incubation period of 7–10 days. The first instar larva is small cylindrical, creamy or light yellow in colour. It measures about 1 mm in length. Its head is light reddish-brown in colour. It bores the fleshy male

Table

Effectiveness of some systemic insecticides against

Treatment	Trial I (23.2.1984) Damaged shoots after 80 days							
	Percentage					Angle		
	RI	RII	RIII	Total	Average	RI	RII	RIII
Phosphamidon 0.05%	0	0	0	0	0	0	0	0
Phosphamidon 0.03%	0	2.00	4.00	6.00	2.00	0	8.13	11.54
Dimethoate 0.05%	0	0	0	0	0	0	0	0
Dimethoate 0.03%	0	3.84	0	3.84	1.28	0	11.24	0
Monocrotophos 0.05%	0	0	0	0	0	0	0	0
Monocrotophos 0.04%	0	0	5.76	5.76	1.92	0	0	14.94
Methyl demeton 0.05%	0	0	0	0	0	0	0	0
Formothion 0.03%	—	—	—	—	—	—	—	—
Thiometon 0.05%	—	—	—	—	—	—	—	—
Thiometon 0.03%	—	—	—	—	—	—	—	—
Methyl-demeton 0.025%	12.00	18.00	15.45	45.45	15.15	20.27	25.10	23.19
Control	90.90	79.62	60.00	230.52	76.84	72.44	63.15	50.77
SE								
CD at 5%								

SE=Standard Error CD=Critical Difference

1

the Khasi pine shoot borer, Dioryctria castanea Bradley.

		Trial II (22.2.1985) Damaged shoots after 108 days									
		Percentage					Angle				
Total	Average	RI	RII	RIII	Total	Average	RI	RII	RIII	Total	Average
0	0	—	—	—	—	—	—	—	—	—	—
19.67	6.55	1.79	1.30	4.59	7.68	2.56	7.71	6.55	12.39	26 65	8.88
0	0	—	—	—	—	—	—	—	—	—	—
11.24	3.74	0	3.70	10.59	14.29	4.77	0	11.24	19.00	30.24	10.08
0	0	—	—	—	—	—	—	—	—	—	—
13.94	4.64	—	—	—	—	—	—	—	—	—	—
0	0	—	—	—	—	—	—	—	—	—	—
—	—	0	0	6 90	6.90	2.30	0	0	15.23	15.23	5.08
—	—	2.63	7.78	1.27	11.68	3.89	9.46	16.22	6.55	32.23	10.74
—	—	4.35	9.42	0	13.77	4.59	72.11	17.95	0	30.06	10.02
68.56	22.85	11.77	14.69	6.67	33.13	11.04	20.09	22.55	15.00	57.64	19.21
186.36	62.12	36.67	17.31	14.38	68.35	22.79	37.29	24.65	22.30	84.24	28.08
	4.65 9.86										6.327 13.79

cones and the young leading shoots forming a tunnel inside from late March to the end of May. The full grown larva is active variable in colour from dirty brown to dark brown and measures about 14.0 mm long and 1.5 mm wide. It is capable of attacking a fresh pine shoot if it falls down from the older attacked shoot. Pupation takes place in last week of April – 1st week of May. The pupa is naked obtect, reddish brown and measures 11–12 mm long and 3–3.5 mm wide. The pupation occurs inside the tunnel, formed by the larva. Emergence of moths takes place in last week of May, when the 2nd generation starts and the moths of second generation are on wing in late June–July after which the insect is not observed in the field.

Materials and Methods

To find out the efficacy of some insecticides against the larvae of *D. castanea*, two field trials were laid out at Yachuli in Hapoli Forest Division (Arunachal Pradesh) on 23rd February, 1984 and 22nd February, 1985. In all, nine treatments viz., phosphamidon 85 EC 0.05% (2.4 ml insecticide/tree), phosphamidon 85 EC 0.03% (1.4 ml insecticide/tree), dimethoate 30 EC 0.05% (6.67 ml insecticide/tree), dimethoate 30 EC 0.03% (4 ml insecticide/tree), monocrotophos 36 EC 0.05% (5.56 ml insecticide/tree), monocrotophos 36 EC 0.04% (4.44 ml insecticide/tree), methyl-demeton 25 EC 0.05% (8 ml insecticide/tree), methyl–demeton 25 EC 0.025% (4 ml insecticide/tree) and an untreated control in trial I and seven treatments viz., phosphamidon 85 EC 0.03% (1.4 ml insecticide/tree), dimethoate 30 EC 0.03% (4 ml insecticide/tree), thiometon 25 EC 0.05% (8 ml insecticide/tree), thiometon 25 EC 0.03% (4.8 ml insecticide/tree), formothion 25 EC 0.03% (4.8 ml insecticide/tree), methyl-demeton 25 EC 0.025% (4 ml insecticide/tree) and untreated control in tiral II were taken. Both the trials were replicated thrice and a single Khasi pine tree of about 4.50 m height was taken as unit per plot. The water emulsion of each of the above insecticidal treatments was formulated on the basis of active ingredient of insecticides and then each marked Khasi pine tree was uniformly sprayed upto run off stage with the help of Maruti Foot sprayer. The observation on the percentage count of damaged shoots in treated and untreated Khasi pine trees were taken after 80 days of spray in trial I and 108 days of spray in trial II. The data pertaining to these trials were transformed to angle and then analysed Angle is equal to Arc sin $\sqrt{\text{Percentage}}$, as given by Bliss (Snedecor, 1950).

Observations and Discussion

The data based on both the trials as given in Table 1 revealed that all the treatments tested were significantly superior to the untreated control in reducing the percentage of damaged shoots of Khasi pine. Phosphamidon 0.05% and 0.03% (2.4 ml and 1.4 ml of insecticide/tree respectively), dimethoate 0.05% and 0.03% (6.67 ml and 4 ml insecticide/tree respectively), Monocrotophos 0.05% and 0.04% (5.56 ml and 4.44 ml insecticide/tree) respectively and methyl-demeton 0.05% (8 ml of insecticide/tree) proved equally effective in permitting 0.00 to 2.00 per cent damaged shoots of *P. kesiya* as compared to 76.84 per cent bored shoots in untreated control trees in trial I. Similar results were also observed in trial II, when phosphamidon 0.03%, dimethoate 0.03%, formothion 0.03%, thiometon 0.05% and thiometon 0.03%, were tested. They reduced respectively damage to shoots down to 2.56, 4.77, 2.30, 3.89 and 4.59 per cent as compared to 22.79 per cent shoots damaged in untreated controls. Methyl-demeton 0.025% (4 ml insecticide/tree), which was less effective in comparison to other insecticidal treatments permitted 15.15 per cent bored shoots in trial I and 11.04 per cent bored shoots in trial II (Table 1).

Thus, it can be concluded that spraying of either phosphamidon 0.03% (1.4 ml insecticide/tree) or dimethoate 0.03% (4 ml insecticide/tree) or monocrotophos 0.04% (4.44 ml insecticide/tree) or formothion 0.03% (4.8 ml insecticide/tree) or thiometon 0.03% (4.8 ml insecticide/tree) in the last week of February was highly effective in reducing the incidence of Khasi pine shoot borer, *D. castanea*.

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SUMMARY

There was an epidemic of Khasi pine shoot borer, *Dioryctria castanea* in 1982 in Yachuli Khasi pine plantations in Arunachal Pradesh. All age groups were attacked. Two field trials were conducted at Yachuli to find out the efficacy of phosphamidon, dimethoate, monocrotophos, methyl-demeton, formothion and thiometon against the shoot borer. Spraying of 0.03% phosphamidon/0.03% dimethoate/0.04% monocrotophos/0.03% formothion/0.03% thiometon in the last week of February was highly effective in reducing the incidence of the shoot borer.

खासिया चीड़ के प्ररोहछिद्रक डायोरिक्ट्रिया कैस्टेनिया (ब्रैडले) (शल्किपक्षा: पायरालिडी) के जातकों के प्रति कतिपय कीटनाशियों की प्रभावकारिता

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सारांश

अरूणाचल प्रदेश में याचुली के खासी चीड़ रोपवन में 1982 में खासिया चीड़ प्ररोहछिद्रक डायोरिक्ट्रिया कैस्टेनिया के कारण व्यापक रोग फैला। सभी उम्रों के वृक्ष आक्रान्त हुये। याचुली में ही इस प्ररोहछिद्रक के प्रति फोस्फामिडोन, डायमैथिएट, मोनोक्रोटोफॉस, मियाइल-डेमेटान, फार्मेथियोन और थियोमेटोन की प्रभावकारिता मालूम करने के लिये दो क्षेत्र परीक्षण कराये गये। 0.03% फास्फोमेडिन/0.03 डायमेथिएट/0.04% मोनोक्रटोफॉस/0.03% फार्मेथियोन/0.03% थियोमेटॉन का फरवरी के अन्तिम सप्ताह में छिड़काव कराना इस प्ररोह छिद्रक का आयात घटाने में बड़े प्रभावकारी रहे।

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IN VITRO ANTIMICROBIAL ACTIVITY OF ESSENTIAL OIL OF NEWLY EVOLVED *EUCALYPTUS* HYBRID FRI-4

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Introduction

Eucalyptus hybrid has been a widely planted species in India owing to its adaptability in different ecoclimatic zones This species is the result of the cross between *Eucalyptus tereticornis* Sm. and *Eucalyptus camaldulensis* Dehn. Since no proper crossing of the suitable clones of these species was made, the resultant exhibited great variation in morphological, physiological and chemical behaviour in the forest. In order to obtain a specific hybrid according to the needs of the country, it was thought worthwhile to produce a species of *Eucalyptus* hybrid from selected clones which may bestow maximum gains in terms of rapid growth leading to high wood yields at shorts rotations. With this objective, the geneticists selected such strains of *Eucalyptus tereticornis* and *Eucalyptus camaldulensis* which could be crossed with maximum advantage.

Hybridization work from the above two species was started in 1965 and a dozen different *Eucalyptus* interspecies crosses and back crosses were carried out at the Forest Research Institute and Colleges, Dehra Dun (Venkatesh & Sharma, 1976, 1977). Of these, F_1 hybrid belonging to the 1970 reciprocal species crosses, *Eucalyptus* hybrid FRI-4 (*E. tereticornis* × *E. camaldulensis*) displayed pronouced degree of hybrid vigour in both height and diameter growth which are the two major components of wood yield from forest trees.

On hydro-distillation method, the leaves from trees of *Eucalyptus* hybrid FRI-4 yield 1.84% of essential oil. The oil contains alpha - pinene, beta - pinene, camphene, phellandrene, alpha - terpinene, limonene, cineole, gammaterpinene, para - cymene, terpinolene, etc (Chaudhari *et al.* 1985; Dayal & Maheshwari, 1985).

Literature survey revealed that a good deal of research work has been done on the antibacterial and antifungal studies of essential oils of *Eucalyptus* spp. (Suri & Thind, 1978; Suri *et al.*, 1979; Thind & Suri, 1979; Suri *et al.*, 1984), but no work has been carried out on the antimicrobial efficacy of essential oil of *Eucalyptus* hybrid FRI-4. Chemical analysis of essential oil of *Eucalyptus* hybried FRI–4 reveal the presence of Alpha–pinene (11.78%), Beta–pinene (13 64%), Phellandrene (4.85%), Alpha–terpinene (0.83%), Limonene (2.24%), Cineole (33 28%), Gamma–terpinene (3.86%), Para-cymene (25.65%), Terpinolene (1.12%) (Chaudhari, 1985) and differ with the chemical constituents of other *Eucalyptus* spp., viz., *E. citriodora*, *E. globulus*, etc. In order to find out biological application of

E. hybrid FRI–4, detailed studies on the antimicrobial efficacy of the oil has been carried out and the results obtained are discussed in this paper.

Material and Method

The essential oil of *Eucalyptus* hybrid FRI–4 was obtained from the leaves by hydro–distillation and dried over anhydrous sodium sulphate. Different dilutions of essential oil viz., 1 : 100, 1 : 250, 1 : 500 and 1 : 1000 were prepared using ethylene glycol as solvent. The pure oil and its aforesaid dilutions has been tested against *Bacillus pumilis, B. mycoides, Escherichia coli, Proteus vulgaris, Salmonella paratyphii, Sarcina lutea, Shigella nigesta, Staphylococcus aureus, Aspergillus niger, Candida albicans, Epidermophyton floccosum, Malbranchea pulchela, Microsporum gypseum, Penicillium notatum.*

The antibacterial and antifungal activity of *Eucalyptus* hybrid FRI 4 oil was screened by filter paper disc–method as suggested by Maruzella & Henry (1958).

Sterilized filter paper disc of 12.5 mm diameter prepared from watman No. 1 were thoroughly soaked in the pure oil and in different dilutions and were placed over Bactonutrient agar and Saborauds dextrose agar media which were freshly seeded with different bacteria and fungi. The petridishes were then incubated for 24 and 48 hours depending upon the growth rate of organisms at 35°C in the case of bacteria and till complete growth at room temperature (26°C) for fungi. The antibacterial and antifungal activities were measured in terms of inhibitory zone as an average of maximum dimension of zone of inhibition around the filter paper disc in four different directions. The results are enumerated in the Table 1 and 2.

Results and Discussions

It is apparent from Table 1 and 2 that the essential oil of *Eucalyptus* hybrid FRI – 4 have maximum antibacterial and antifungal activity when tested undiluted but the activity decreases as the dilution increases.

In the case of bacteria, the pure oil showed highest inhibitory activity against *Shigella nigesta* (36.0 mm) and least against *Bacillus mycoides* and *Sarcina lutea* (24.0 mm). It is pertinent to point out that even upto the dilution of 0 : 1000, the oil has been found active against all the test organisms.

It the case of fungi, the pure oil gave highest inhibitory activity against *Microsporum gypseum* (30.0 mm) and least against *Epidermophyton floccosum* (21.0 mm). The test oil shows inhibitory effect against all the test organisms even upto the dilution of 1 : 1000 except *Epidermophyton floccosum.*

Since the test organisms are human parasites, therefore, this oil can be recommended for allopathic and homoeo pathic therapeutic preparations against the diseases caused by these microbes hence this oil can be used for the preparation of many valuable industrial products.

Table 1

Antibacterial activity of essential oil of Eucalyptus hybrid FRI-4

Organisms*	Diameter of zone of inhibition** (mm)					Control Ethylene-glycol
	Pure oil (100%)	1 : 100	1 : 250	1 : 500	1 : 1000	
Bacillus pumilus	26.0	22.5	20.0	17.5	15.0	Inactive
B. mycoides	24.0	21.0	18.5	16.5	14.0	-do-
Escherichia coli	28.5	25.0	21.0	19.0	16.5	-do-
Proteus vulgaris	31.0	28.0	24.0	21.5	17.5	-do-
Salmonella paratyphi	26.0	23.0	20.5	18.0	15.5	-do-
Sarcina lutea	24.0	20.5	19.0	17.0	14.5	-do-
Shigella nigesta	36.0	30.5	25.5	22.0	19.0	-do-
Staphylococcus aureus	29.5	26.0	22.5	19.5	17.0	-do-

Table 2

Antifungal activity of essential oil of Eucalyptus hybrid FRI-4

Organisms*	Diameter of zone of inhibition** (mm)					Control Ethylene-glycol
	Pure oil (100%)	1 : 100	1 : 250	1 : 500	1 : 1000	
Aspergillus niger	23.0	18.0	16.5	15.0	13.0	Inactive
Candida albicans	28.5	23.0	20.5	18.0	16.0	-do-
Epidermophyton floccosum	21.0	17.5	15.5	13.0	Inactive	-do-
Malbranchea pulchela	24.0	20.0	18.5	17.0	14.5	-do-
Microsporum gypseum	30.0	25.0	21.0	19.0	16.5	-do-
Penicillium notatum	29.0	24.5	21.0	18.5	16.5	-do-

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*Source : Department of Botany, University of Saugar, Sagar (M.P.)

**Includes the diameter of paper disc (12.5 mm)

SUMMARY

The essential oil of newly evolvd *Eucalyptus* hybrid FRI-4 at various dilutions has been tested for its antimicrobial activity against various organisms. The pure oil has been found to be most active against all the test organisms. Even at dilution of 1 : 1000, the oil has been found to be active against all the test organisms except *Epidermophyton floccosum*. It is therefore, recommended for pharmaceutical preparations.

नये विकसित किए गए संकर युकेलिप्टस एफाराई-4 के उत्पत तेल की काचीय अणुजीव विरोधी क्रियाशीलता

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सारांश

नए विकसित किए गए शंकर युकेलिप्टस एफाराई-4 का उत्पत तेल कई अवमिश्रणों में विभिन्न जीवों के प्रति जीवाणु विरोधी सक्रियता के लिए परीक्षित किया गया। परीक्षा किए गए सभी अवमिश्रणों में जीवों के प्रति यह शुद्ध तेल सर्वाधिक सक्रिय रहा। यहां तक कि 1 : 1000 के अवमिश्रण में भी यह तेल एपिडर्मोफायटन फ्लेकोस्सम को छोड़ अन्य सभी परीक्षित जीवों के प्रति सक्रिय रहा। अत: दवाई बनाने में इस तेल का उपयोग अभिस्तावित किया जाता है।

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GAMMA RAY IRRADIATION STUDIES IN *LEUCAENA LEUCOCEPHALA* (LAM.) DE WIT. I. EFFECT ON GERMINATION AND SEEDLING HEIGHT M_1

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Introduction

Mutation work has been extensively undertaken on crop plants but very little effort has been put on the induction of mutations in tree species. The reluctance to use mutation technique in the improvement of tree species may partly be due to long life cycles usually of few years from seeding to flowering and partly due to the fact that most of the tree species are out breeders and generates variability. In this context *Leucaena leucocephala* is an ideal tree species for undertaking mutation induction since it is highly self-pollinated and flowers within a year of seeding It is a multi-purpose tree and extensively planted for fuel, fodder and small timber. By virtue of its fast growth, the species is being tried in agro-forestry and silvipastoral system. Due to its self pollinating nature, natural variability is wanting and needs to be created. Crossing and mutation induction are the two possible approaches to create variability. Since *Leucaena* flowers are very small and crossing is tedious, mutation technique is an alternative in this direction.

In any mutation breeding programme the initial step is to find out an appropriate dose to be used. L.D. 50 dose is considered to be the most desirable from the practical point of view. In the present study effect of different doses of gamma rays on germination and seedling height was studied and L.D. 50 dose for germination percentage worked out.

Material and Methods

Seeds of *Leucaena leucocephala* (Lam) de Wit. Var. K-8 were treated with gamma rays (Co^{60}) with 20, 30, 40, 50, 60 and 70 Kr doses. One hundred and fifty seeds were treated with each dose and same number of untreated seeds served as control. Since *Leucaena* seeds need hot water treatment to facilitate germination, pre and post-hot water treatments were administered.

Pre-hot water treatment : Boiling water was added to seeds kept in beaker and seeds allowed to remain in it for 24 hours. Excess of water was blotted out and seeds were irradiated.

Post-hot water treatment : After irradiation of seeds, boiling water was added to irradiated seeds kept in beakers and allowed to remain in it for 24 hours. Pre and post-hot water treatments were adjusted in such a way that both the lots were available for sowing at the same time.

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The seeds were sown in raised beds of 1 m × 6 m with 25 cm height. The upper 10 cm layer of seedbed consisted of a mixture of soil, FYM and sand in a ratio of 2 : 1 : 1. The bed was divided longitudinally in two equal halves. Cross word lines were made at 10 cm and a shallow furrow opened. The treated seeds of each dose as well as control were divided in three parts and each part was sown as two lines/replication in randomised block design with three replications.

Observations on seed germination, seedling lethality sectorial chimeras were recorded. Observations on seedling height were recorded after 33 days of seeding.

The observations on germination percentage were transformed to angular values before subjecting them to ANOVA. In case of seedling height observations on ten seedlings, taken at random, were recorded per replication and mean subjected to ANOVA.

For determining L.D. 50 the germination observed in control was taken as 100 per cent and observed values of germination in each dose were converted to per cent of control and plotted in the graph. A parallel line to abscissa at 50 per cent germination of control was drawn. From the point where this line intercepted a plotted line, a perpendicular was dropped on the abscissa. The point of interception of the perpendicular at abscissa was read as L.D. 50.

Results and Discussion

It is a common practice to determine the effect of radiation on some biological traits. The extent of reduction in the traits measured is taken as criteria for radiation sensitivity. In the present study germination percentage and seedling height form the two traits that have been studied for their radiosensitivity.

Germination and seedling height : The time lapse between the seeding and emergence of seedlings was observed to increase with the radiation dose. The seedlings showed various abnormalities like lethal seedlings, sectorial chimera, deformity of leaves etc.

Table 1 gives M.S. for germination percentage and seedling height. Although pre and post-hot water treatment as well as its interaction with treatment did not show significant differences, the treatments do show them.

Table 1.

Mean sum of Squares for germination and seedling height

Due to	D F.	Germination (%)	Seedling height
Replication	2	18 30	2.71
Pre Vs Post (W) hot water	1	64.38	0.30
Treatments (T)	6	285.46**	0 37*
Interaction (WXT)	6	3 99	0 02
Error	26	59.56	0.13

It is seen from Table 2 that the germination percentage decreases with the increase in dose. Although 20 Kr and 30 Kr doses had no effect on germination, rest of the doses showed significant reduction in germination percentage as compared to control. The comparison among different radiation doses revealed that the doses 20 Kr to 60 Kr are at par but the dose of 70 Kr significantly reduced germination percentage over the doses 20 Kr and 30 Kr.

The observations on seedling height revealed that the doses 20 Kr to 50 Kr had no effect on seedling height. However, the doses 60 Kr and 70 Kr significantly reduced germination percentage. The comparison among different radiation doses showed that 70 Kr dose significantly reduced seedling height over the 20 Kr dose. The seedling height also decreased with the increase in dose.

Pre Vs post-hot water treatment : Although pre and post-hot water treatments and their interaction with radiation dose did not show significant differences, the observations on general trend are interesting. In general pre-hot water treatment showed more drastic effect than post-hot water treatment both for germination percentage and seedling height (Table 2). This observation is further strengthened from the fact that pre-hot water treatment gave rise to more number of lethal seedlings as well as sectorial chimera than the post-hot water treatment (Table 3). The more drastic effect of pre-hot water treatment as compared to that of post-hot water treatment can perhaps be attributed to relatively high water content of the former. It has long been known that pre soaked seeds, which have correspondingly high water content and whose physiological activity has started, are much more sensitive to radiation than seeds with

Table 2

Mean for germination percentage and seedling height

Treatment	Germination Percentage			Seedling height (cm)		
	Pre-hot water	Post-hot water	Mean	Pre-hot water	Post-hot water	Mean
Control	59.33	58 33	58.83	3.08	3.37	3.22
20 Kr	52.66	54.66	53.66	2.96	3.34	3.15
30 Kr	49.35	52.66	51.00	2.97	3.01	2.99
40 Kr	46.66	50.00	48 33	2 87	2.95	2.91
50 Kr	43.66	47.00	45.33	2.82	2.86	2.84
60 Kr	43.33	46.66	44.99	2.64	2.78	2.71
70 Kr	35.66	39.33	39.49	2.41	2.60	2.50
Mean	47.24	49.70	—	2.82	2.99	—
S.E. (m) T.	3.15			0.15		
C.D. at 5%	9.16			0.43		
S E. (m) W	1.68			0.08		
C.D. at 5%	—			—		
S.E. (m) WXT	4.45			0.21		
C.D. at 5%	—			—		

Table 3

Number of lethal seedlings and sectorial chimera

Dose in Kr	No. of lethal seedling		No. of sectorial chimera	
	Pre-hot water treatment	Post-hot water treatment	Pre-hot water treatment	Post-hot water treatment
0	0	—	—	—
20	2	—	—	—
30	2	—	—	—
40	3	1	—	—
50	4	2	2	—
60	3	4	3	2
70	5	3	3	1

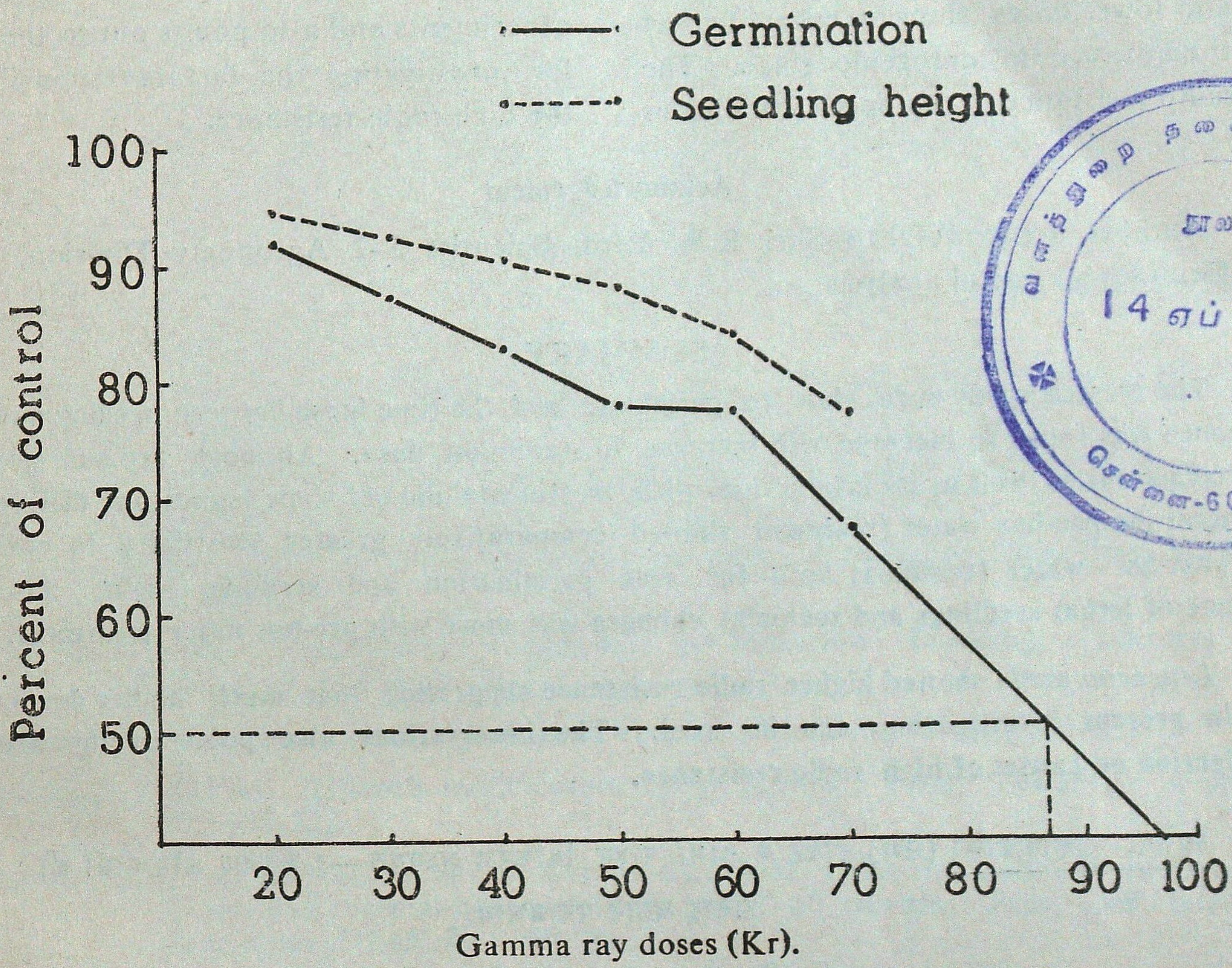
normal water content (Caldecott, 1955; Gustafsson, 1947; Ehrenberg, 1955 and Stadler, 1928).

Action of radiation on biological system : The greater time lapse between the seeding and emergence of seedling and more reduction in seedling height with increase in radiation dose can perhaps be explained on the basis of action of radiation on biological system. It is known that ionising radiations have an inhibitory effect on Cell Division (Lee, 1947). Besides, the biological system is also affected by hydrolysis products The radiation treatment leads to hydrolysis of water and free radicals are formed causing chemical reaction generally detrimental to cell function (Randolph & Haber, 1960; and Luse, 1970) and with the increase in dose the concentration of these radicals increases (Bieble & Pape, 1952 and Priadecenco *et al.*, 1958). The initial inhibition of mitosis and cell elongation affects the seedling emergence and growth. As such it is logical to deduce that the detrimental effect of radiation will increase with the dose. Indeed the present observations do confirm this fact as observed by Konzak and Singleton (1952), Swaminathan and Natrajan (1956) and Chaturvedi *et al.* (1982).

The observation that the initial drastic effect on germination percentage with 40 Kr and 50 Kr doses disappears with advance in ontogenic stage is very interesting. It is clear from Table 2 that while these two doses were effective in reducing germination percentage, they proved ineffective in reducing seedling height. Thus, the doses 40 Kr and 50 Kr showed recovery effect with the advance in ontogenic stage as observed by Moutschen (1958).

L.D. 50 for germination : L.D. 50 is considered to be a most appropriate dose for recovering maximum mutations. Taking germination percentage as a criterion, L.D. 50 was found to be 87 Kr (Fig.1). This is

Fig. 1



Effect of gamma rays on germination and seedling height and L.D.-50 for germination.

வனத்துறை தலைவர் அலுவலகம்
நூலகம்
14 எப் 1988
சென்னை-600 006

very high dose indeed as Sparrow *et al.* (1965) reported that woody species are more sensitive than herbaceous species. Kapoor (1980) also reported LD-50 of about 20 Kr for *Eucalyptus* and other tree species. But the fact that the some dose (20 Kr) in present investigation proved to be ineffective in affecting germination percentage leads one to conclude that *Leucaena* is more resistant to gamma ray irradiation. It is well known that same dose of mutagenic treatment cause quite a different degree of effect in different species. For example, the sensitivity of *Pinus alba* to X-rays was found to be about 200 times that of *Sinapsis alba* seeds (Gustafsson and Wettstein, 1958).

The question arises as to what could be the probable factors that confers such a high radio resistance to *Leucaena*. This aspect needs thorough investigation. Pending such an investigation it can be speculated that high radio resistance of *Leucaena* to irradiation may perhaps be attributed to its hard impervious seed coat, polyploid nature of the species (Konzak and Singleton 1952; Mackey, 1968), small chromosome size (Sparrow and Gunkel, 1956) and high chromosome number (Sparrow *et al.*, 1961 and Sparrow and Woodwell, 1962).

Conclusion

The study thus showed that *Leucaena* seed germination and seedling height reduction increases with the increase in radiation dose and lower doses show recovery effect with the advance in ontogenic stage. The high radio resistance of the species indicates that higher doses should be used in mutation experiments and also points out to the need for investigating the factors responsible for the high radio resistance.

Acknowledgement

Authors are thankful to Shri R.R. Patil, Scientist S-2 Agronomy Division, IARI New Delhi for statistical analysis.

SUMMARY

The treated seeds were slow to germinate and the time lapse between seeding and seed emergence was found to increase with increase in radiation dose. Although pre and post-hot water treatment as well as its interaction with treatments did not show significant differences, in general the pre-hot water treatment showed comparatively greater sensitivity to radiation than post-hot water treatment both for seed germination and seedling hight. Also, the insidence of lethal seedlings and sectorial chimera was more with pre-hot water treatment.

Leucaena **seeds showed higher radio resistance suggesting that much higher doses, than used in present investigation, can be used. The observations also point to the need for investigation on causes of high radio resistance.**

ल्यूसेना ल्यूकोकेफाला (लेम) डेविट के गामा रश्मि विकिरण अध्ययन—I अंकुरण और पौधों की ऊंचाई बढ़ाने पर प्रभाव

वाई०जी० खामनकर व बी०वी० सिंह

सारांश

उपचारित बीजों का अंकुरण मन्द रहा और बोने और पौधे निकलने के बीच का समय भी विकिरण की मात्रा बढ़ाने पर बढता पाया गया। यद्यपि गर्म पानी से पहले और उसके बाद के उपचार तथा उपचारों के साथ इसकी क्रिया-प्रतिक्रिया में कोई सार्थक अन्तर नहीं देखा गया सामान्यत: गर्म पानी से पूर्व उपचार की विकिरण के प्रति प्रभविष्णुता तुलनात्मक दृष्टि से अधिक रही बनिस्बत उत्तर गर्म जल उपचार के साथ। यह बात अंकुरण और पौधों की ऊंचाई दोनों में देखी गई। पूर्व गर्म जल उपचार के साथ मर गये पौधे और चित्रोति आधात भी अधिक पाया गया।

ल्यूसेना के बीजों में बिकिरण प्रतिरोधिता भी अधिक दिखाई दी जिससे लगता है कि इस अन्वेषण में प्रयुक्त मात्राओं से कहीं अधिक मात्राए उपयोग की जा सकती हैं। ये पर्यवेक्षण अधिक विकिरण प्रतिरोधिता का कारण खोजने की आवश्यकता की ओर भी इंगित कराते हैं।

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ALBIZIA PROCERA BENTH, A NEW HOST FOR *CERCOSPORA ALBIZIAE*

V. NATH, N.S.K. HARSH, C.K. TIVARI AND P.S. REHILL*

Disease Insect Survey Unit,
Regional Forest Research Centre, Jabalpur (Madhya Pradesh)

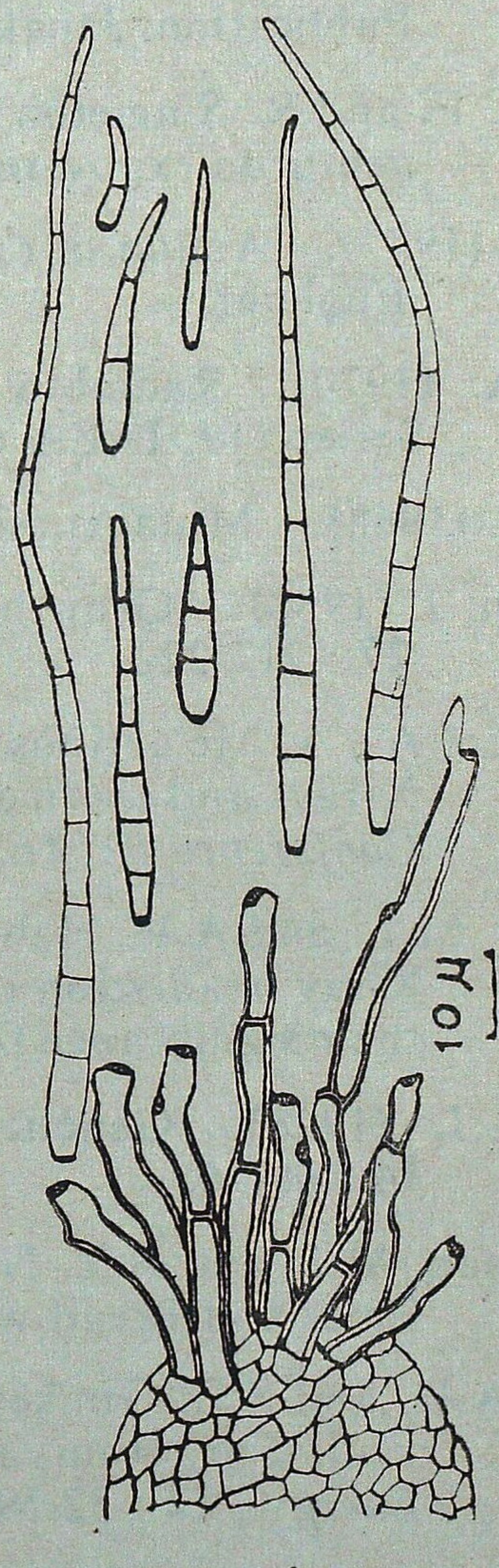
Introduction

During survey of forests and forest nurseries around Jabalpur (M.P.), a severe fungal infection on leaves of *Albizia procera* Benth., was observed. The disease was first noticed during February, 1984. The fungus develops circular to irregular greyish to greyish-brown spots on the leaflets and rachii and causes premature leaf fall. The fungus has been identified as *Cercospora albiziae* Kar & Mandal and is described belw :

1. *Cercospora albiziae* Kar & Mandal (Kar and Mandal, 1969).

Spots amphigenous on leaflets and rachii, circular to irregular, greyish to greyish-brown, surrounded by narrow brown ring, occasionally with shot holes; fruiting amphigenous; stromata few to many, globose to subglobose, dark brown, 10–50 μm in diameter, fascicles dense with 3-60 widely divergent stalks; conidiophores pale to light-brown, lighter and narrower towards tip, sometimes irregular in width, distinctly 1–9 septate, straight to slightly geniculate unbranched, spore scars distinct, 25–100 × 3.5–5.0 μm; conidia hyaline, acicular to obclavate, 1–20 septate, straight to curved, base truncate to short obconically truncate, tip subacute to subobtuse, 13.3–150 × 2.5–5.8 μm.

Fig. 1



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Conidiophores and conidia of *Cercospora albiziae.*

Collected on living leaflets and rachii of *Albizia procera* Benth. from Neemkheda, Jabalpur (M.P.); Feb. 8, 1984; Jan. 18, 1985 and Feb. 19, 1986.

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* Formerly Coordinator, Disease Insect Survey, F.R.I. and Colleges, Dehra Dun (India)

No *Cercospora* species has so far been reported on *A. procera* (Bilgrami *et al.*, 1979, 1981). *C. albiziae* was earlier reported by Kar and Mandal (1969) on *A lebbeck* (L.) Benth. from West Bengal (India). The pathogen on *A. procera* slightly differs in size of conidiophores and conidia from that described by Kar and Mandal while other characters are similar.

SUMMARY

Cercospora albiziae **Kar & Mandal has been described on a new host** *Albizia procera* **Benth.**

एलबीजिया प्रोसेरा बेन्थ—सेर्कोस्पोरा एल्बिजियेई का नया पोषी

बी० नाथ, एन०एस०के० हर्श, सी०के० तिवारी व पी०एस० रेहिल

सारांश

सेर्कोस्पोरा एल्बिजियेई कार व मंडल को एक नये पोषी एल्वीजिया प्रोसेरा बेन्थ० से वर्णित किया गया है।

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* * *

ACER PINNATINERVIUM MERRILL—A MAPLE NEW TO THE INDIAN FLORA

K.C. SAHNI* AND H.B. NAITHANI**

Introduction

Genus Acer Linn. is represented by about 118 species occurring in North America, N.W. Africa, Asia and Malesian Islands; 16 species occur in India (Nayar and Dutta, 1982) During botanical exploration of Kameng District, Arunachal Pradesh in the autumn of 1978 specimens of an interesting maple were collected. After critical examination these were identified as *Acer pinnatinervium* This poorly known species was described by Merrill (1941) on the basis of the collections made by the great plant explorer Captain F. Kingdon Ward on 6th January 1931 from hills east of Nam Tisang and also above Nam Tamai River from Upper Burma. There is no report on the occurrence of this species from India. It is therefore now being reported for the first time from Arunachal Pradesh, India. As no description of it is available in the Flora of British India by Hooker, a description along with an illustration is provided to facilitate determination of this tree in other localities in India and outside.

Acer pinnatinervium Merrill in Brittonia 4 : 109. 1941.

Tree 25 m high, glabrous, bark dark grey, reticulately fissured, branches terete. *Leaves* firmly papery or slightly leathery, entire, above when dried olive coloured, beneath snow-white, glabrous, elliptic or oblong-elliptic, abruptly caudate-acuminate, base rounded, 10–15 × 3-6 cm; main nerves on both sides 8–12, curved, forming a network, brownish beneath, elevated, very distinct; petiole 1-6 cm long, glabrous. *Flower* unknown. *Samara* coppery pink, about 2.5 cm long, wings divergent in a acute angle, falcate, roundish, 7-9 mm broad, glabrous.

Specimen examined

Below Peri La 2200 m, Kameng District (Arunachal Pradesh), 28.10.1978, *K C. Sahni & H.B. Naithani*, K.C.S. Ser. II No. 807 (DD).

Although this species manifestly belongs in the group with *Acer laurinum* Hassk., and has the characteristic snow-white lower leaf surface of that and the other closely allied species, it differs in its strictly pinnate-nerved leaves, the leaf base not at all 3 or 5 nerved.

Like *A. laurinum* the wood of *A. pinnatinervium* may be used for making poles.

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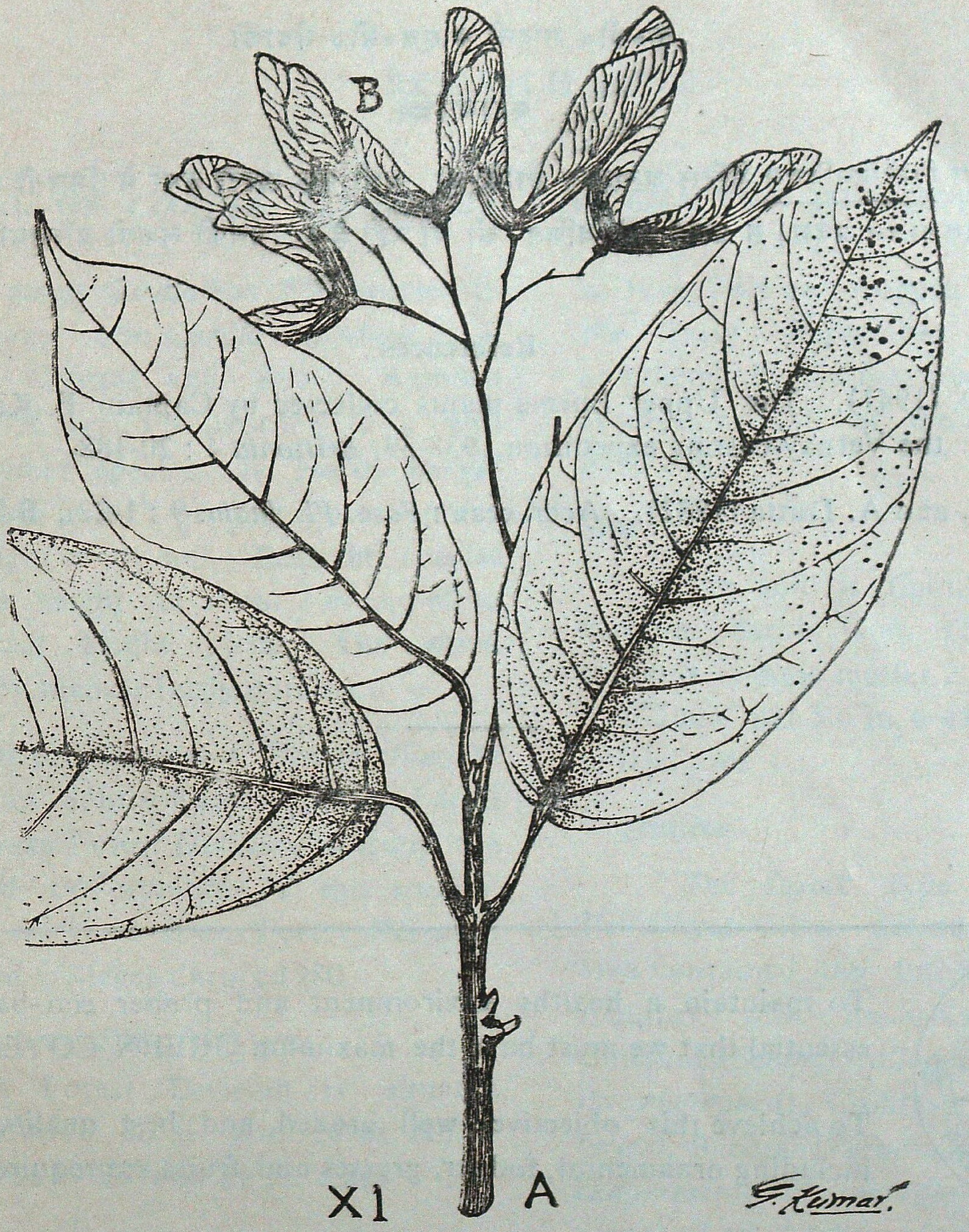

Acer pinnatinervium Merrill. A. Twig, B. Samara.

Acknowledgement

Authors are grateful to Dr. Peter F. Stevens, Harvard University Herbarium, Cambridge, Massachusetts, U.S.A. for confirmation of its identity, to the Officers and Staff of Forest Department, Arunachal Pradesh for providing facilities, and to Shri G. Kumar, Chief Artist for the illustration.

SUMMARY

Acer pinnatinervium Merrill, a poorly known species, so far known from Upper Burma is now being reported for the first time from India (Arunachal Pradesh). The wood of it may be used for making poles.

एसेर पिन्नेटिनर्वियम मेरिल--भारतीय पेड़-पौधों मे एक नया कुट्टिदारु (मेपिल)

के०सी० साहनी व एच०बी० नैथाणी

सारांश

एसेरा पिन्नेटिनर्वियम मेरिल अल्पज्ञात जाति को अभी तक ऊपरी बर्मा में मिलती ज्ञात थी, अब प्रथम बार भारत (अरूणाचल प्रदेश) से प्राप्त हुई वर्णित की जा रही है। इसकी लकड़ी बल्लियां बनाने के काम आ सकती हैं।

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RESEARCH NOTE

TRIAL OF *CORDIA ALLIODORA* PROVENANCES IN NORTH BENGAL

The genus *Cordia* has 250 species in tropics, among them *Cordia alliodora* indigenous to Central and South America between 25°N to 25°S latitude is a well known timber species. In North Bengal *Cordia oblique* and *C. grandis* occur sporadically in light sandy soil. Both the species grow to a height of about 7 m and 60 to 90 cm breast height girth. The wood produced by them is fairly durable.

Eight provenances of *Cordia alliodora* were tried in South Rajabhatkhawa Forest Block of Buxa Forest Division to study the growth and performance of the species. Seeds were received from Forest Research Institute and Colleges during 1980.

Locality factors of the trial area

Buxa Forest Division is situated between latitude 26°31′ and 26°48′ North and longitude 89°28′ and 89°55′ East.

Temperature

The average day temperature varies from 15.5°C to 21°C from November to February, betwen 27° to 32°C from May to September and between 24° to 27°C during rest of the year. Frost is not known in the area.

Rainfall

Rainfall is from South-west monsoon, which brings rain by the later part of May. The rains are very heavy during the month of June, July and August. It subsides from the early September and disappears completely by the first week of October. The average rainfall of the place of trial is 3570 mm.

Soil

The soil is light, friable loam of varying depth from 15 to 90 cm and contains organic matter 2 to 2.8%, nitrogen 0.30% and pH 5.0 in 0-45 cm layer of soil in trial area.

Vegetation

The forest type is 3b/E6 East Himalayan moist deciduous Forest. Trial area contained the forest of Sal (*Shorea robusta*) with its usual associates viz., Chilaune (*Schima wallichii*), Champ (*Michelia champaca*), Chikrase (*Chukrasia tabularies*), Bahera (*Terminalia belerica*), Sidha (*Lagerestroemia parviflora*), Tun (*Cedrela toona*), Lali (*Amoora wallichii*), Lahasune (*Amoora rohituka*), Semul (*Bombax ceiba*), Parari (*Streospermum chelonoides*) etc.

Nursery and planting methods

Randomized block design was followed while laying out nursery beds and planting seedlings of the various provenances.

Seeds were put in the nursery bed during February 1980 and transplanted in the polypot when the seedlings are about

Table 1

Details of Cordia alliodora provenances

FRI No.	Origin	Latitude	Longitude	Altitude (m)	Rainfall (mm)	Mean temperature °C
794 (i)	Tres Piedras, Honduras Republic	13°02′N	87°04′W	+ 110	1850	27.8
794 (ii)	Finca La Fortuna, Honduras	15°36′N	87°58′W	± 210	1048	25.6
794 (iii)	San Francisco	15°40′N	87°02′W	± 40	2487	23.7
794 (iv)	Esteli, Nicaragua	13°02′N	86°19′W	8-900	—	22.6
794 (v)	Pineda, Nicaragua	12°45′N	86°45′W	± 750	—	23.2
794 (vi)	Finca El Chilero Guatemala	14°23′N	90°′28W	13–1400	—	20.44
794 (vii)	Finca Rincon Alegra, Guatemala	14°27′N	91°46′W	120	2901	26.1
794 (viii)	Nueva Guinea Nicaragua	11°43′N	84°26′W	220	—	26.1

10 cm in height and retained till they came of plantable size about 30 cm in height.

The planting pits of 45 cm³ were prepared at a spacing of 2.5 m × 2.5 m. About 30 cm high seedlings were planted in pits with the onset of monsoon. Three weedings and cleanings were carried out in first year, two in second year and three in third year.

Results

The data on survival percentage, growth in height and breast height girth of various provenance of *C. alliodora* along with growth of teak and a few local species on the same site is given in Table 2.

It appears from Table 2 that survival rate of all the provenances is above 80%. The mean annual height growth of FRI 794 (ii) (Finca La Fortuna, Honduras) is highest and the next in order is FRI 794 (iii) (Sanfrancisco, Honduras) and the minimum are of FRI 794 (iv) and (vi) Esteli Nicaragua, and Finca El Chilero Guatemala. The maximum m.a.g.i. is of FRI 794 (v) (Pineda, Nicaragua) and minimum of FRI 794 (iv) and (vi) Esteli, Nicaragua and Finca El. Chilero, Guatemala.

Cordia puts on comparable height and girth increment as *Michelia* whereas *Gmelina's* rate of height growth is higher but the growth in girth is comparatively

Table 2

Growth of Cordia alliodora and other species.

(Date of measurement 3.4.1987)

Name of species	Provenance	Age (years)	Survival	Average Ht (m)	Growth in girth (cm)	Mahi* (cm)	Magi** (cm)
Cordia alliodora	FRI 794 (i)	6	80	5.20	24.6	0.86	4.1
	,, 794 (ii)	6	86	5.90	24.5	0.98	4.0
	,, 794 (iii)	6	90	5.60	24.6	0.93	4.1
	,, 794 (iv)	6	85	4.60	21.4	0.76	3.51
	,, 794 (v)	6	86	5 00	27.0	0.83	4.5
	,, 794 (vi)	6	85	4.50	21.0	0.75	3.5
	,, 794 (vii)	6	87	5.30	22.2	0.88	3.7
Michelia champaca	Seed stand of S.R V K-15	9	100	6 16	36 1	68	4 0
	Seed stand of Mendabari	9	100	7.13	38.7	79	4.3
Gmelina arborea	Local	10	88	17.00	35.7	1.70	3.5
Tectona grandis	Bamanpokri	5	100	5.90	28.0	1.18	5.6
	South Bholka	5	100	5.10	27.0	1.02	5.4

* M.a.h i. = Mean annual height increment
** M a.g.i. = Mean annual girth increment

low. Mean annual height and girth increments are maximum in teak among the species tried.

No disease and insect attack on *Cordia* was noted during the period.

From the initial indication it appears that the species has prospects in North Bengal. The species casts lighter shade so lot of undergrowth grows under the plants even after third year and has leafless period of 4 to 5 months under North Bengal condition. So, it has prospects in Agroforestry plantations.

Further study is in progress.

A.K. Lahiri

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INDIAN FORESTER
P.O. New Forest-248006 Dehra Dun (U.P.), India

GAZETTE NOTIFICATIONS

ANDHRA PRADESH GAZETTE

The following postings and transfers are notified :—

(1) The posting of Shri P. Narender, Asstt. Conservator of Forests as Divisional Forest Officer, Flying Squad, Nirmal is cancelled and he is posted as Sub-D.F.O. Hyderabad.

(2) The posting of Shri Mohd. Rahmatulla, as Sub-D F.O., Achampet Headquarters at Kollapur is cancelled and he is posted as Divisional Forest Officer, Flying Squad, Nirmal.

(3) Shri V.P. Venkateswarlu, Divisional Forest Officer, Bamboo Weighment Division, Sree Rayalaseema Paper Mills, Kurnool is transferred and posted as P.A. to Conservator of Forests, Logging Project Circle, Rajahmundry.

(4) Shri T. Raja Rao, Asstt. Conservator of Forests, P A to Conservator of Forests, Logging Project Circle, Rajahmundry is transferred and posted as Divisional Forest Officer, Social Forestry Division, Chittoor.

(5) Shri K. Ganapathi Rao, Divisional Forest Officer, Social Forestry Chittoor is transferred and posted as Divisional Forest Officer, Bamboo Weighment Division, Sree Rayalaseema Paper Mills, Kurnool.

(6) Shri G. Vidyasagar, Asstt. Conservator of Forests is transferred and posted as Divisional Forest Officer, Wild Life Sanctuary, Medak.

(7) Shri K. Madan Mohan, Asstt. Conservator of Forests and Sub-Divisional Forest Officer, Hyderabad is transferred and posted as Divisional Forest Officer, Flying Squad–II, Hyderabad.

(8) Shri M. Surya Rao, Silviculturist, Rajahmundry is transferred and posted as Divisional Forest Officer, Social Forestry, Srikakulam.

(9) Shri G. Biksham, Divisional Forest Officer, Social Forestry, Srikakulam is transferred and posted as Silviculturist, Rajahmundry.

(10) Shri A. Upender Rao, Asstt. Conservator of Forests on leave is posted as Divisional Forest Officer, Vizianagaram.

(11) The Services of Shri S. Ibrahim, Asstt. Conservator of Forests, under orders of transfer, are placed at the disposal of Urban Development Authority, Visakhapatnam, initially for a period of one year under the terms and conditions mentioned in the Annexure to this order.

(12) The Services of Shri B. Rambabu, Asstt. Conservator of Forests, presently Divisional Forest Officer, Urban Development Authority, Visakhapatnam are withdrawn and he is posted as Asstt. Conservator of Forests, Mutta Regulation, Narsipatnam.

(13) Shri M. Darshanam, Working Plan Officer, Warangal is transferred and posted as Divisional Forest Officer, Flying Squad, Guntur.

FRI Publications

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1. Silviculture of Indian Trees, Vol. V
   (Symbol No. PFRI-194)
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2. Indian Forest Record (New Series)
   Forest Influence Vol. 3, No. 1—1984
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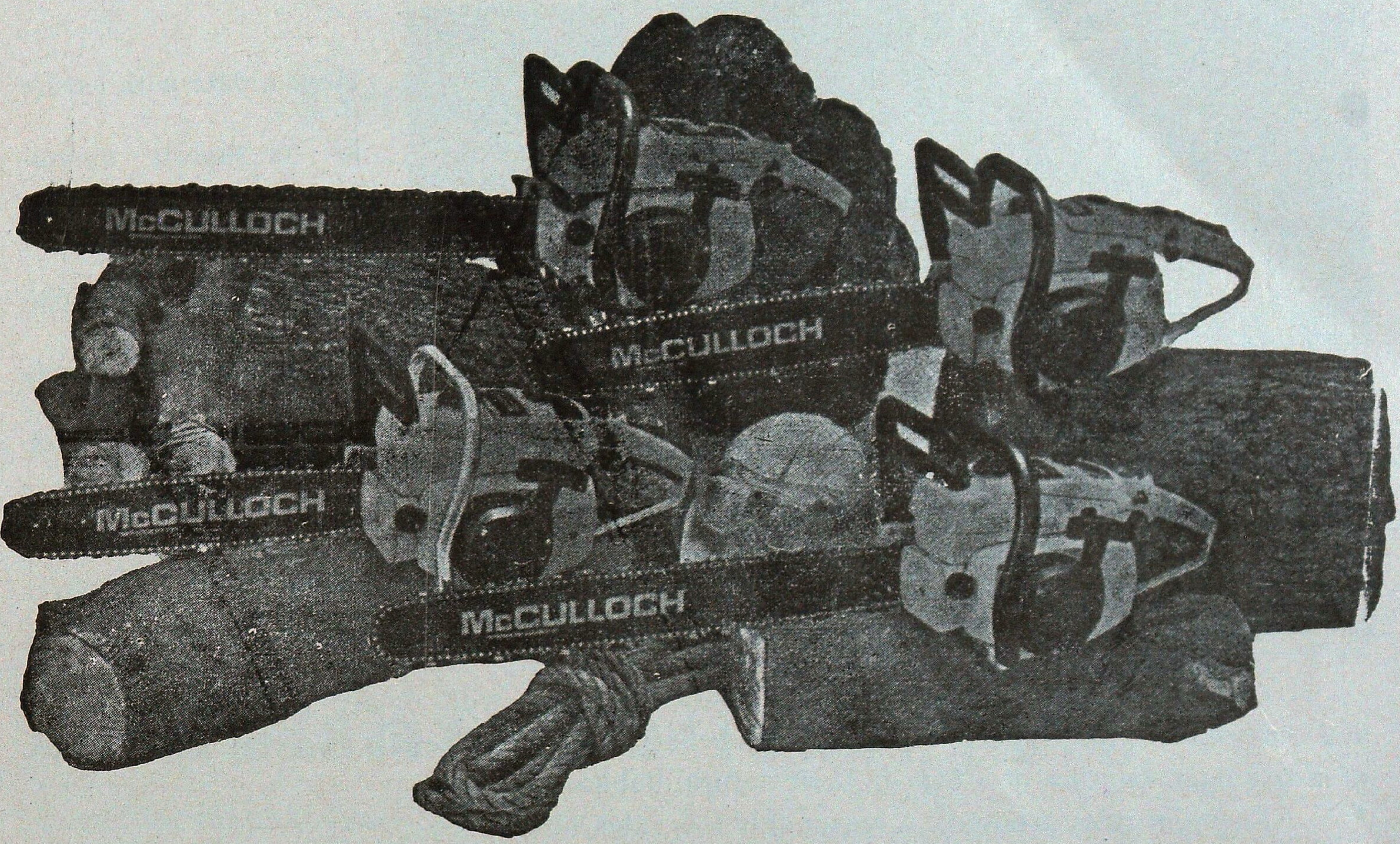

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OR

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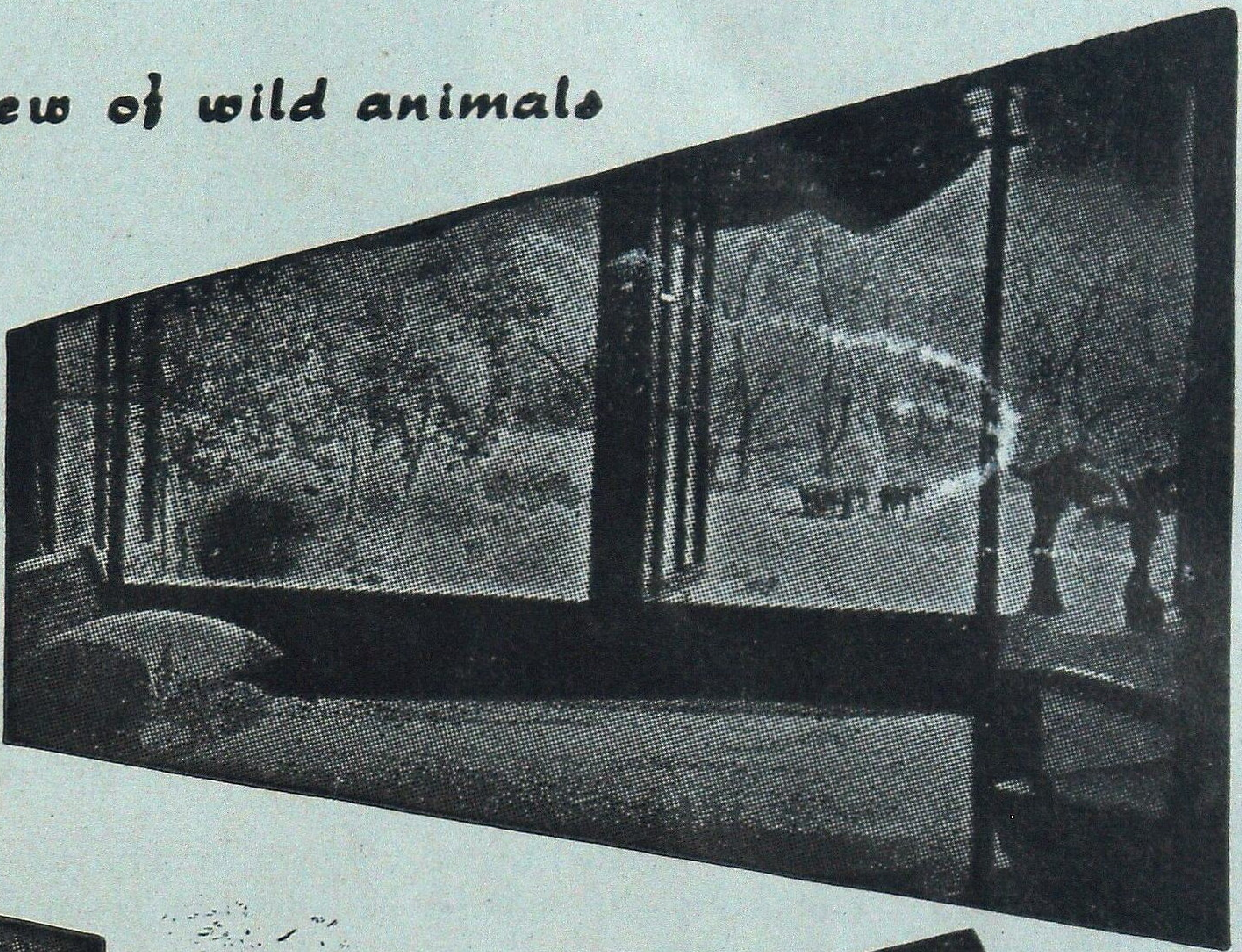

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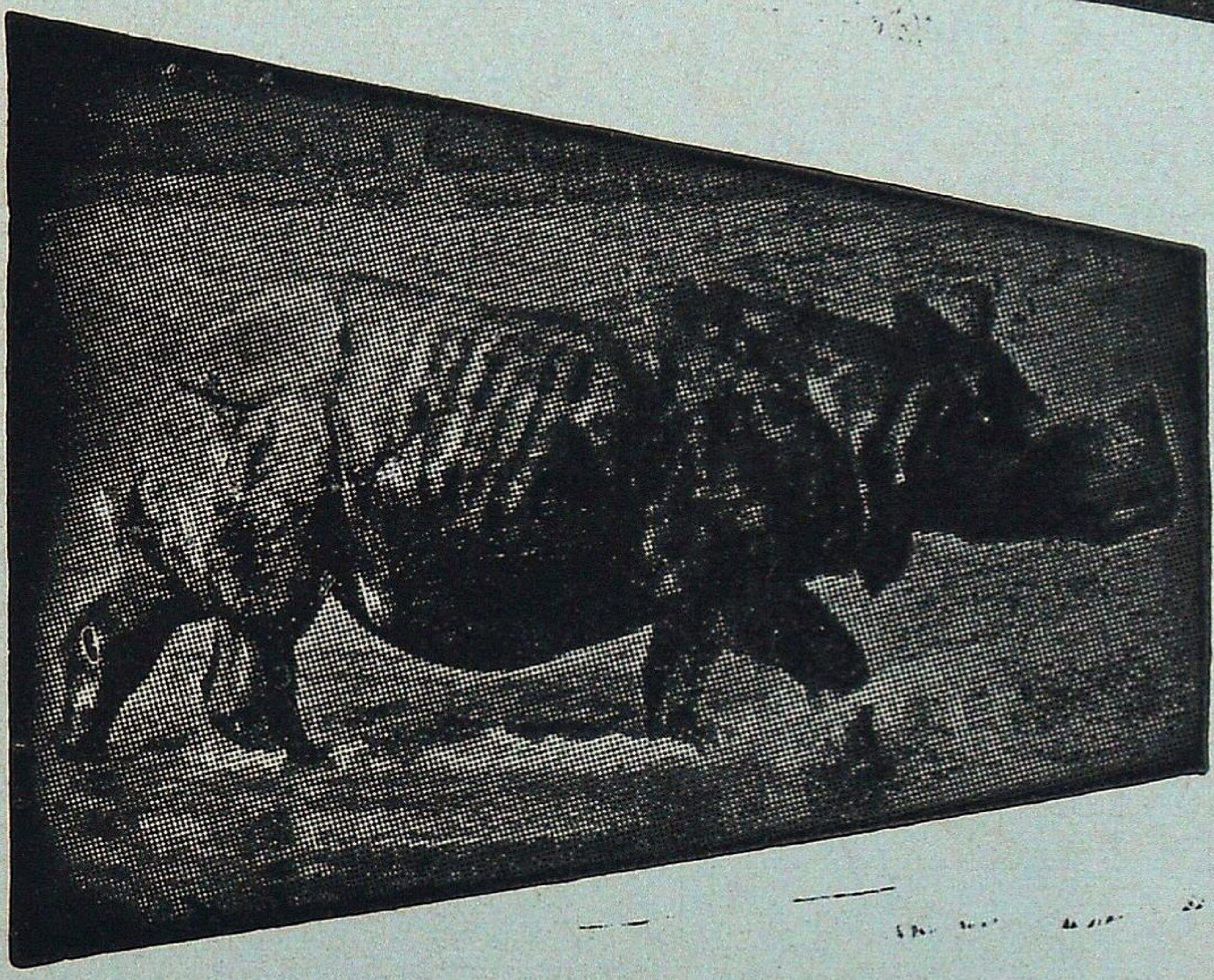

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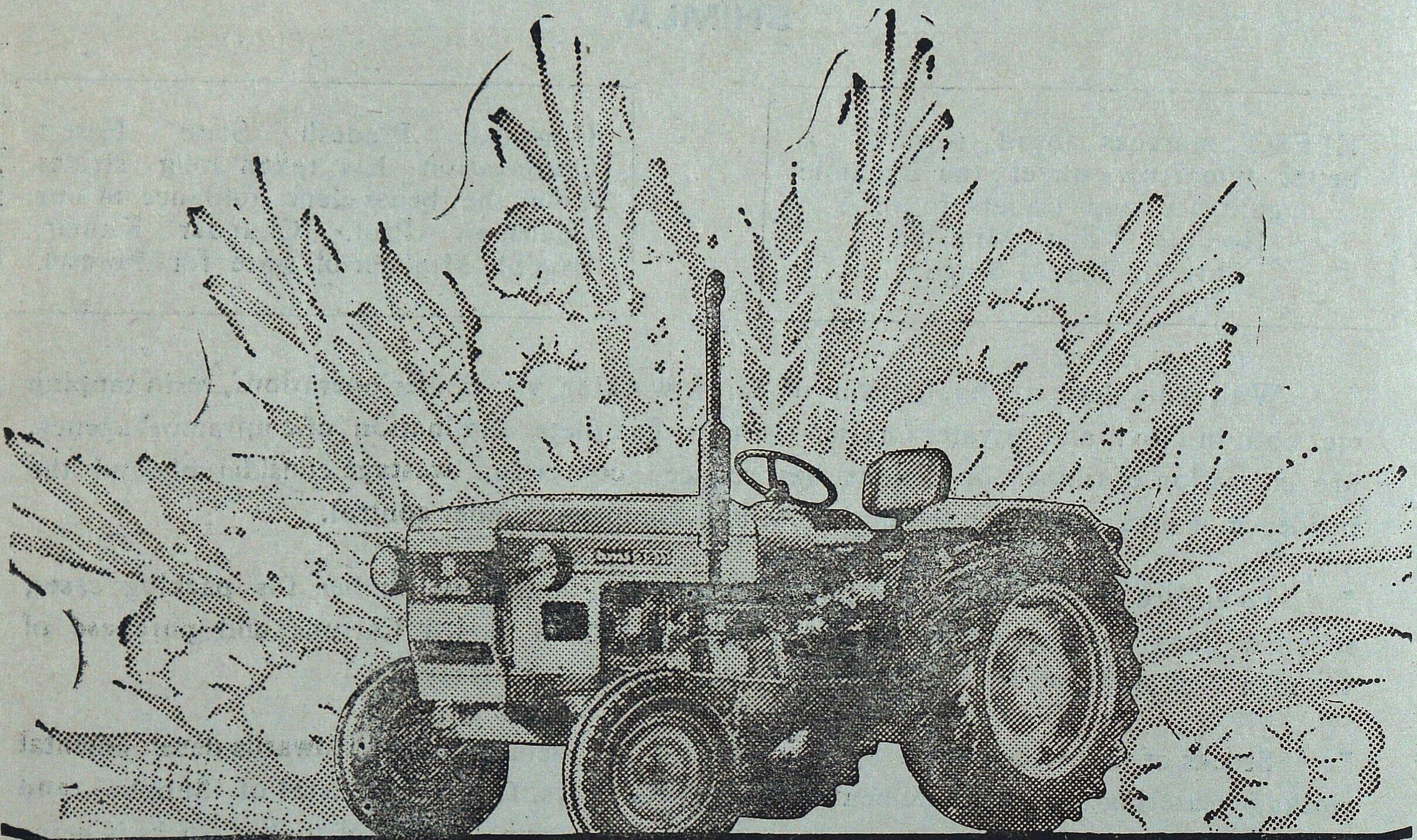
(V.P. Mohan)
Managing Director.



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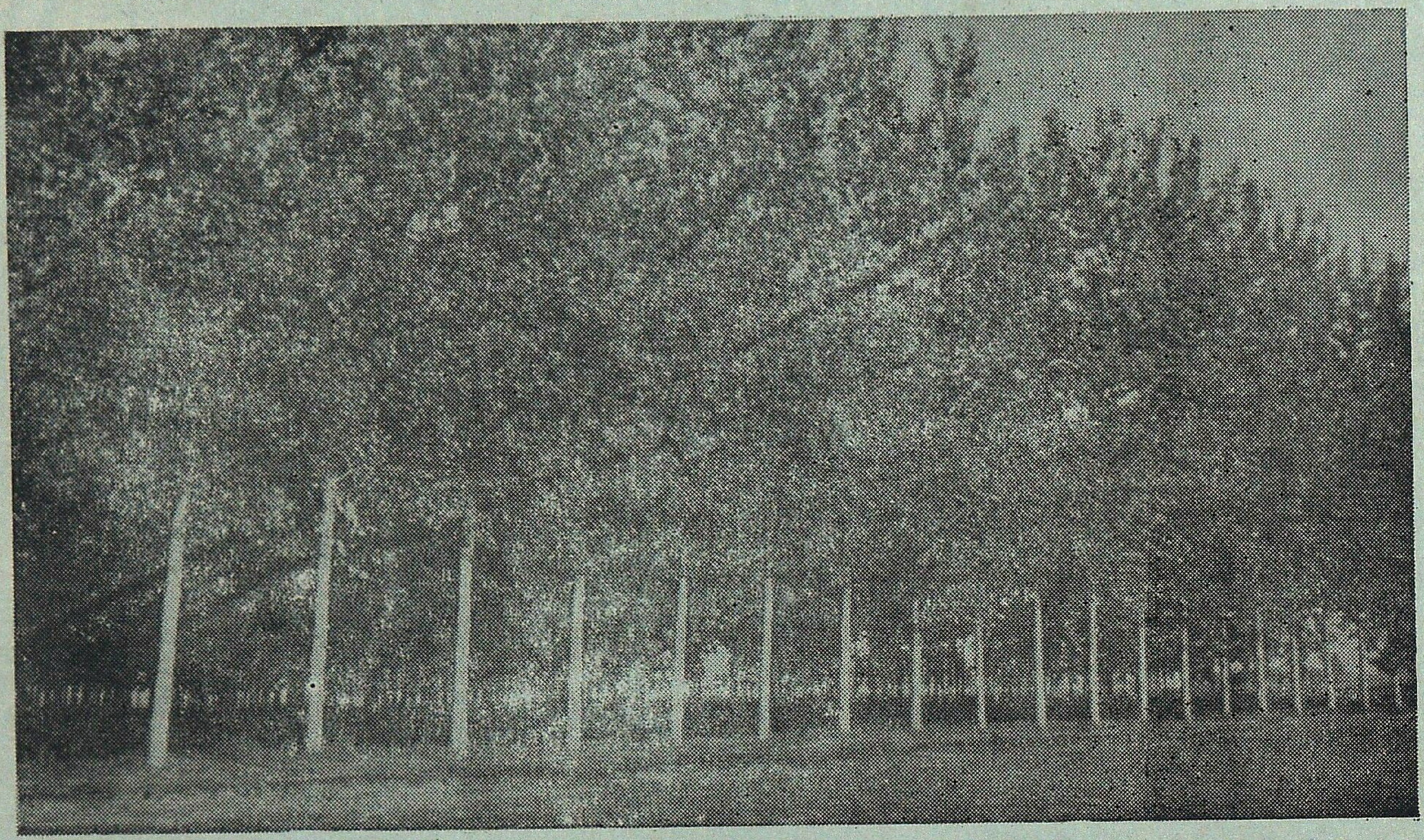

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Karnal : 843, Sector 13,
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Mizoram Forests Through The Years

During the British period i.e. from 1890 till the year 1952, the management of Inner Line Reserved Forests was done under the supervision of Superintendent of District. The District was put under 'Excluded Area' and practically no Statutory Act or Law were enforced to manage the Forests. Practically nothing had been done. The Inner Line Reserved Forests was constituted under the Assam Forest Regulation comprising an area of 559 sq. kms.

When the Mizo District Council came into being in 1952, the management of all the Forest other than the State Inner Line Reserved Forests was handled by the District Council. Thence the District Council started to make its own Forest Wing. Under the District Council one Forest Division called Aizawl Forest Division was created comprising the then whole area with headquarters at Aizawl. In fact during the time of the then District Council, most accessible areas of the forests had been overtapped for earning more revenue and due to population pressures.

In the early 1960's the first plantations were raised by the District Council in different centres. During the year 1966—1968, practically no plantation could be raised due to political disturbance in the Mizo District.

After Mizoram became a Union Territory in the year 1972, the Union Territory Government formed one more Forest Division with headquarters at Lunglei.

The present position of Mizoram Forest Department may be summed up as follows :

The Mizoram Forest Department is headed by the Chief Conservator of Forests. The field work has been taken up with ten (10) Territorial Divisions. In addition to this, six (6) Functional Divisions have been set up. There are now three (3) Circles namely—Southern Circle, Northern Circle and Research & Development Circle. The Government of Mizoram has already eonstituted three Wildlife Sanctuaries in order to preserve its vanishing Wildlife. Four more Wildlife Sanctuaries are being proposed which are likely to be constituted very soon. The Mizoram Forest Department has created 1,00,029 hectares of plantation upto 1987 as against 967 hactares before it attained U.T. Status.

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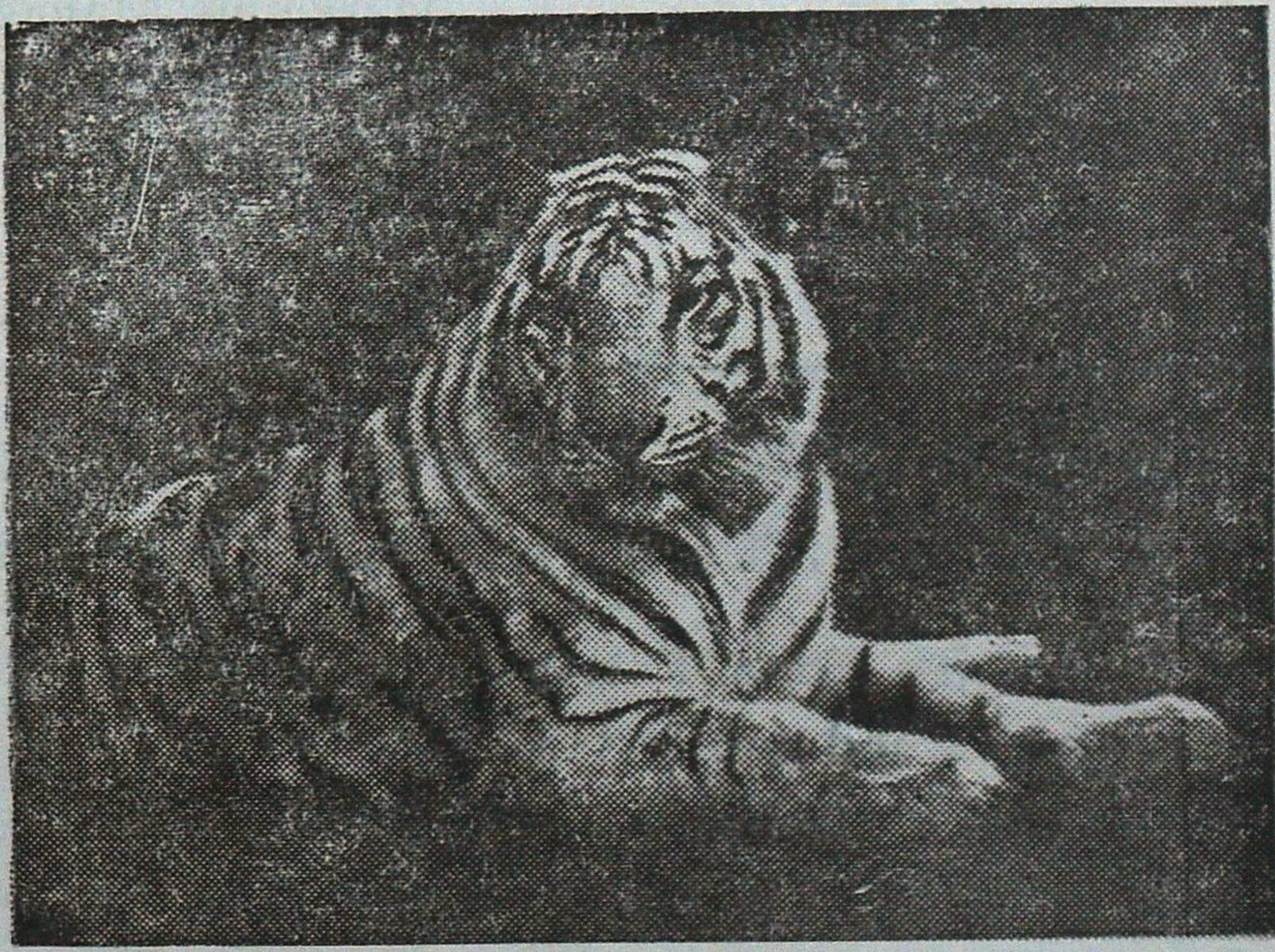

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Recently, the Corporation has established the use of eucalyptus on commercial scale in fabrication of packing cases and manufacturing door and window frames.

For further details, please contact the Managing Director, Punjab State Forest Development Corporation Limited, Chandigarh.

Y.P. CHOWDHRY
MANAGING DIRECTOR

Madhya Pradesh Forges Ahead : Forestry for the People

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Issued by :

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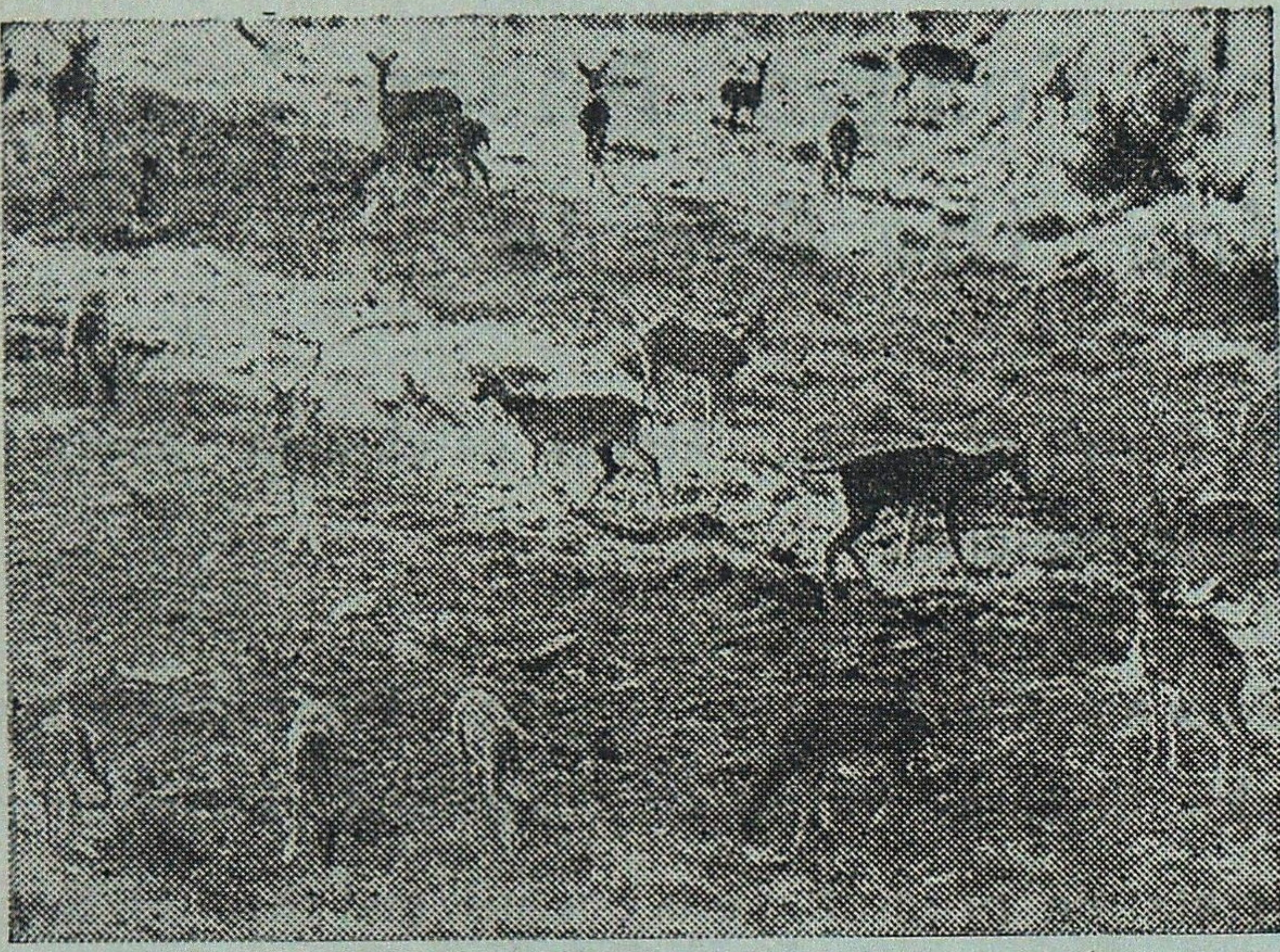

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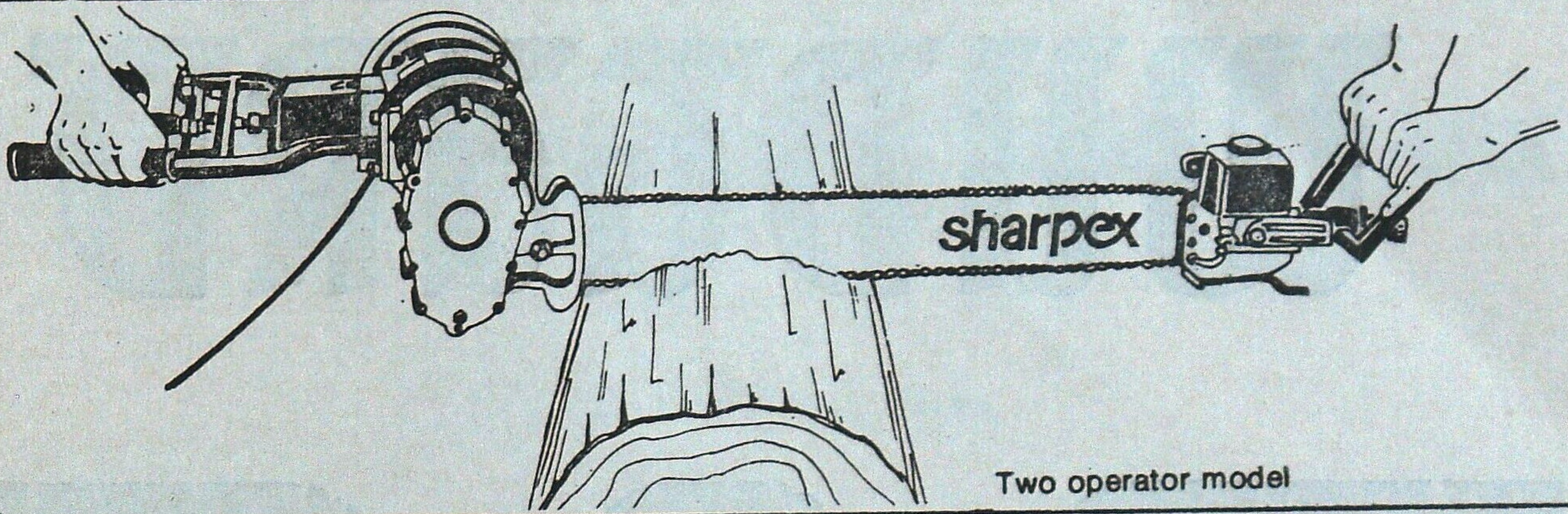

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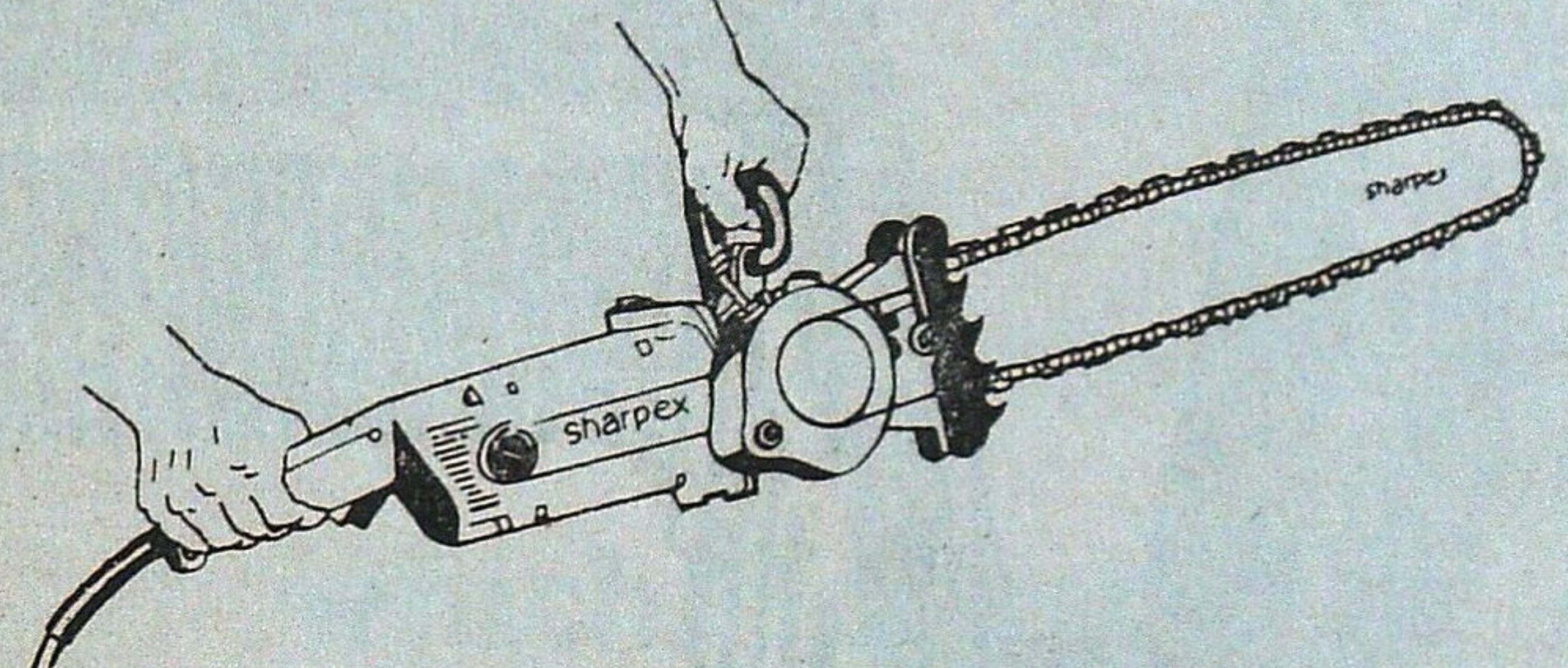

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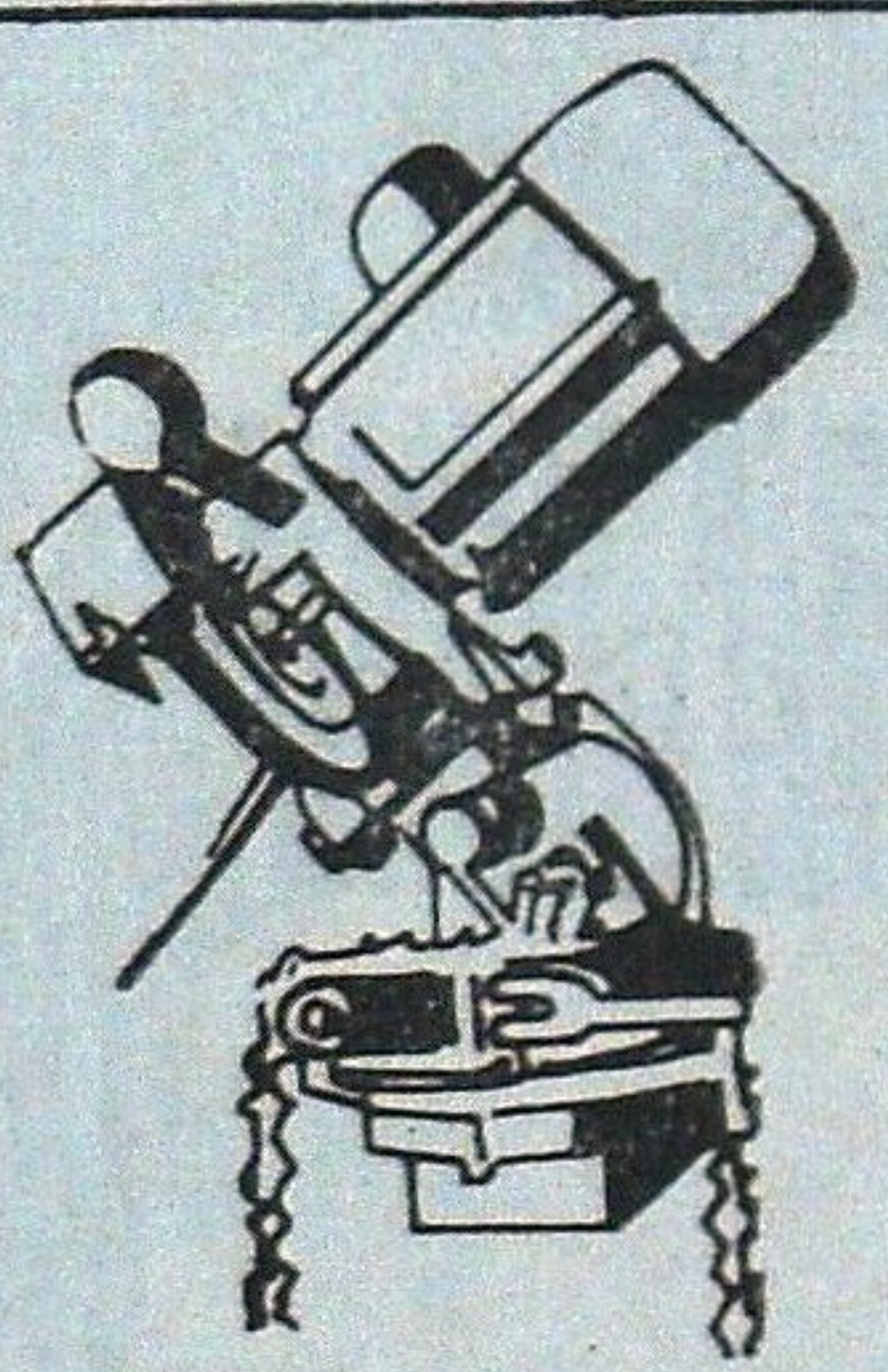

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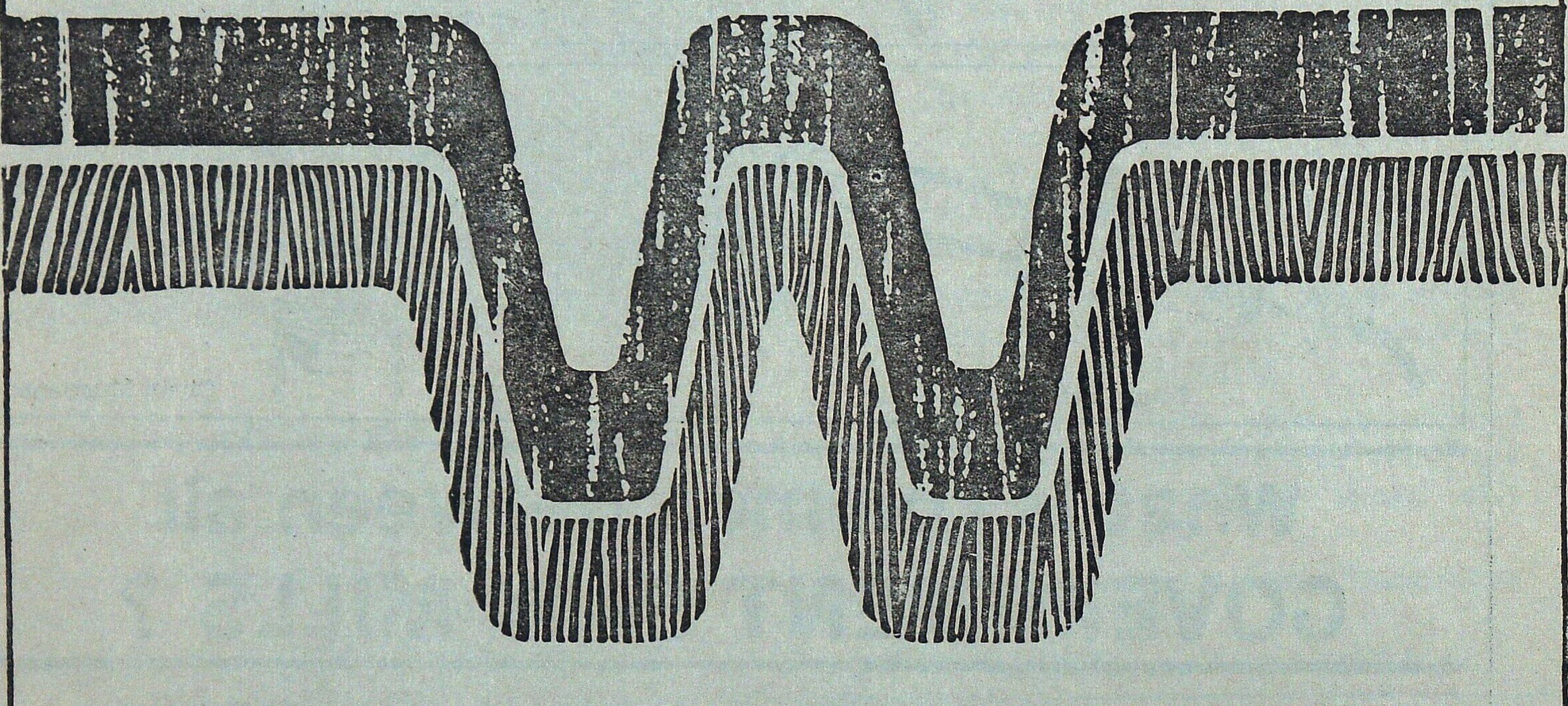

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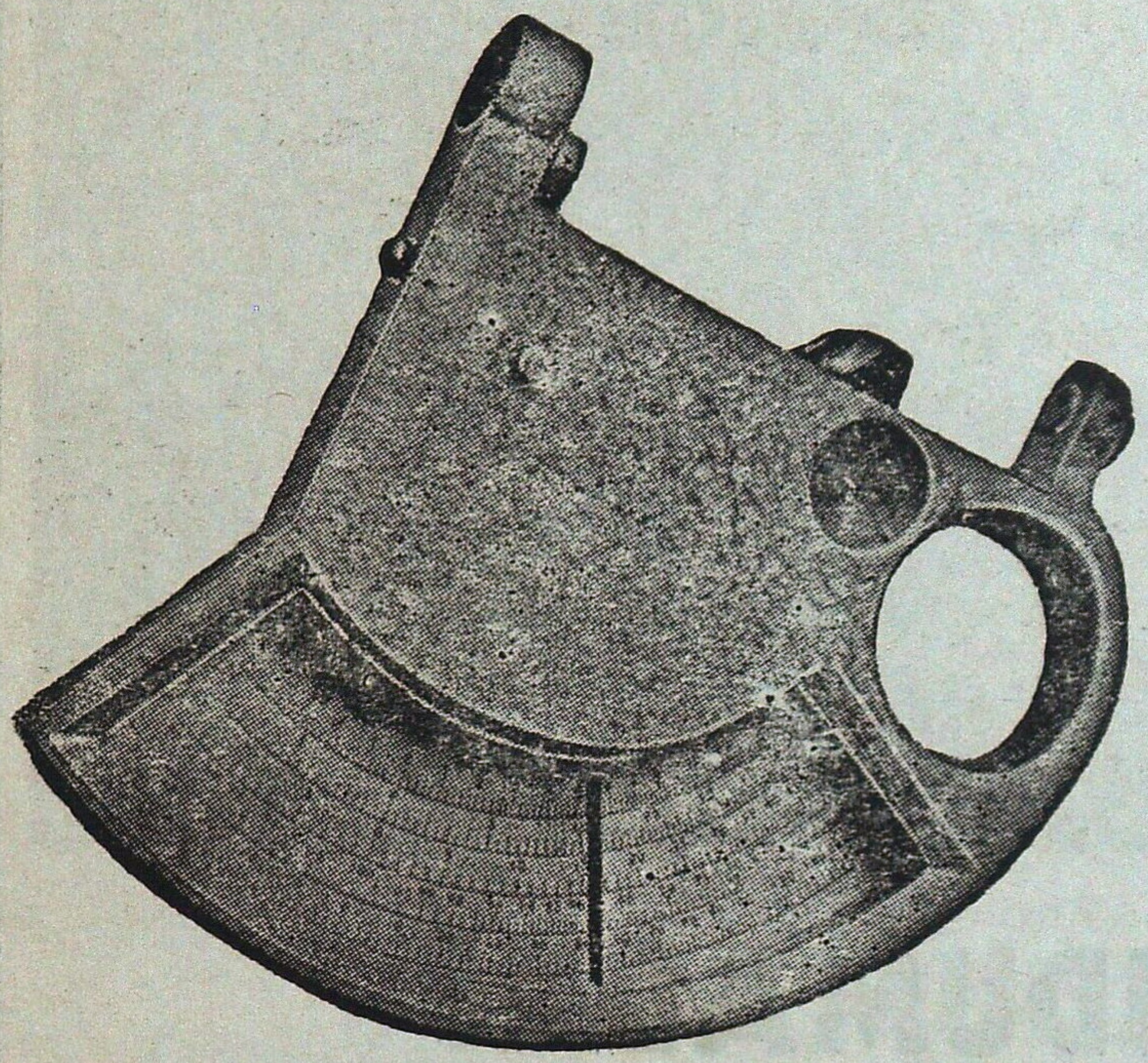

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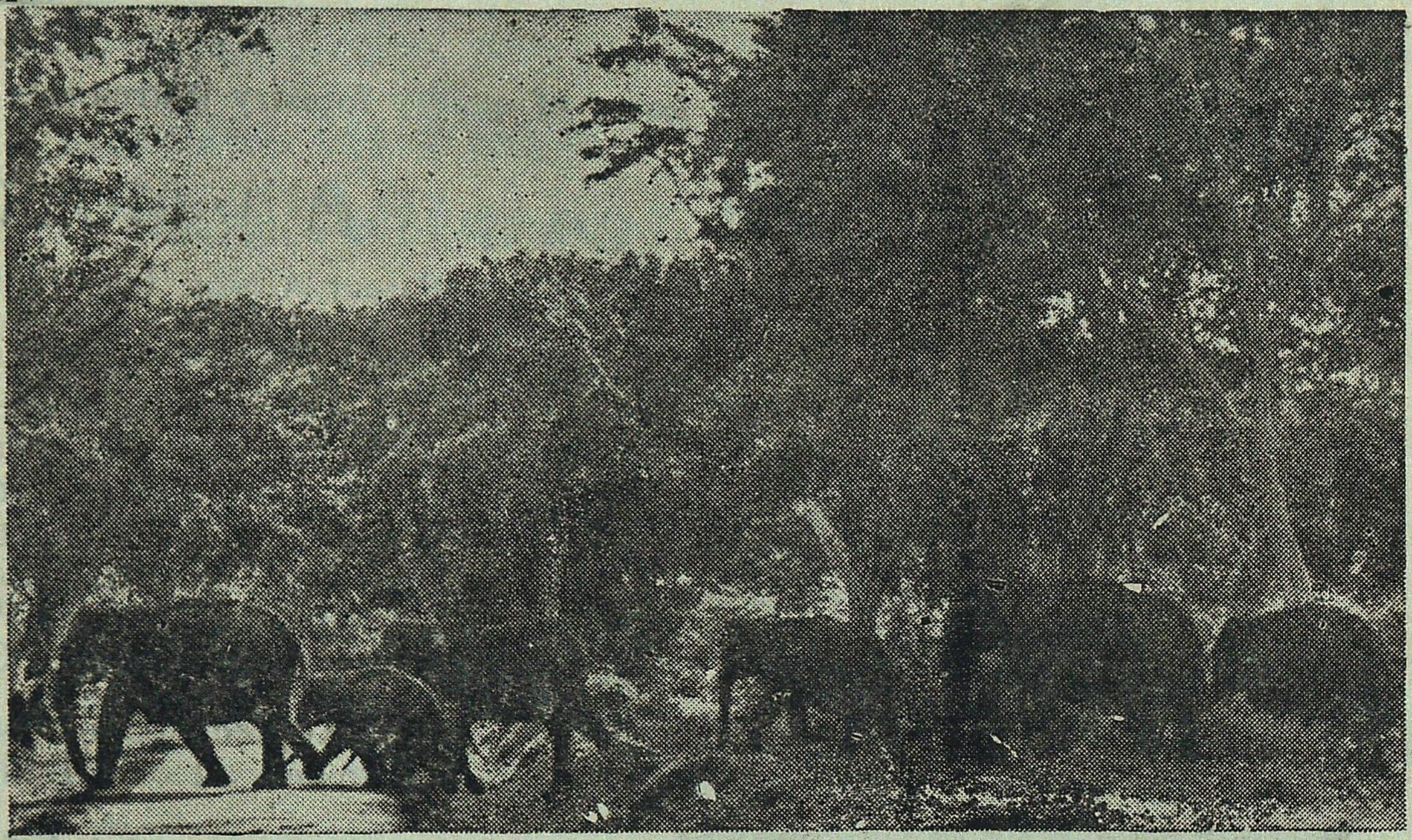

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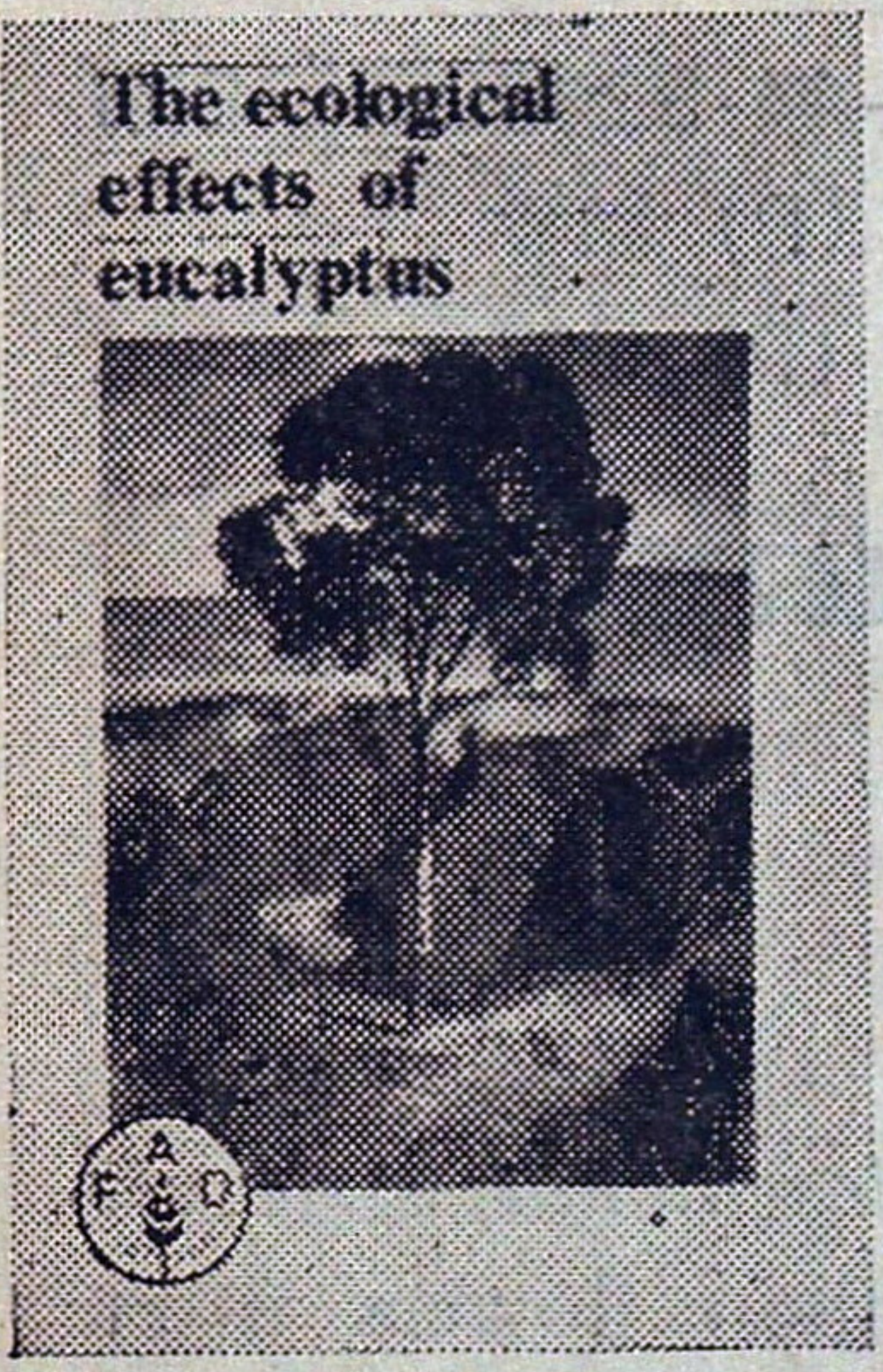

There has been a growing body of opinion that claims that eucalyptus cause a variety of short to long term ills, impoverishing the environment in respect of the soils, water availability and wildlife even where plantations have been planted on wastelands devoid of tree cover. Some countries have even banned the planting of eucalyptus. It was because of the mounting criticism on one side and the large potential benefits that eucalyptus can confer on forestry programmes in developing countries on the other that FAO decided to accept the offer made to it by the Swedish International Development Agency (SIDA) to carry out this study. The aim of the study is to analyse as dispassionately and objectively as possible the available information on the ecological effects of eucalyptus and present the results in a condensed form. A book that argues in favour of the species plantation.

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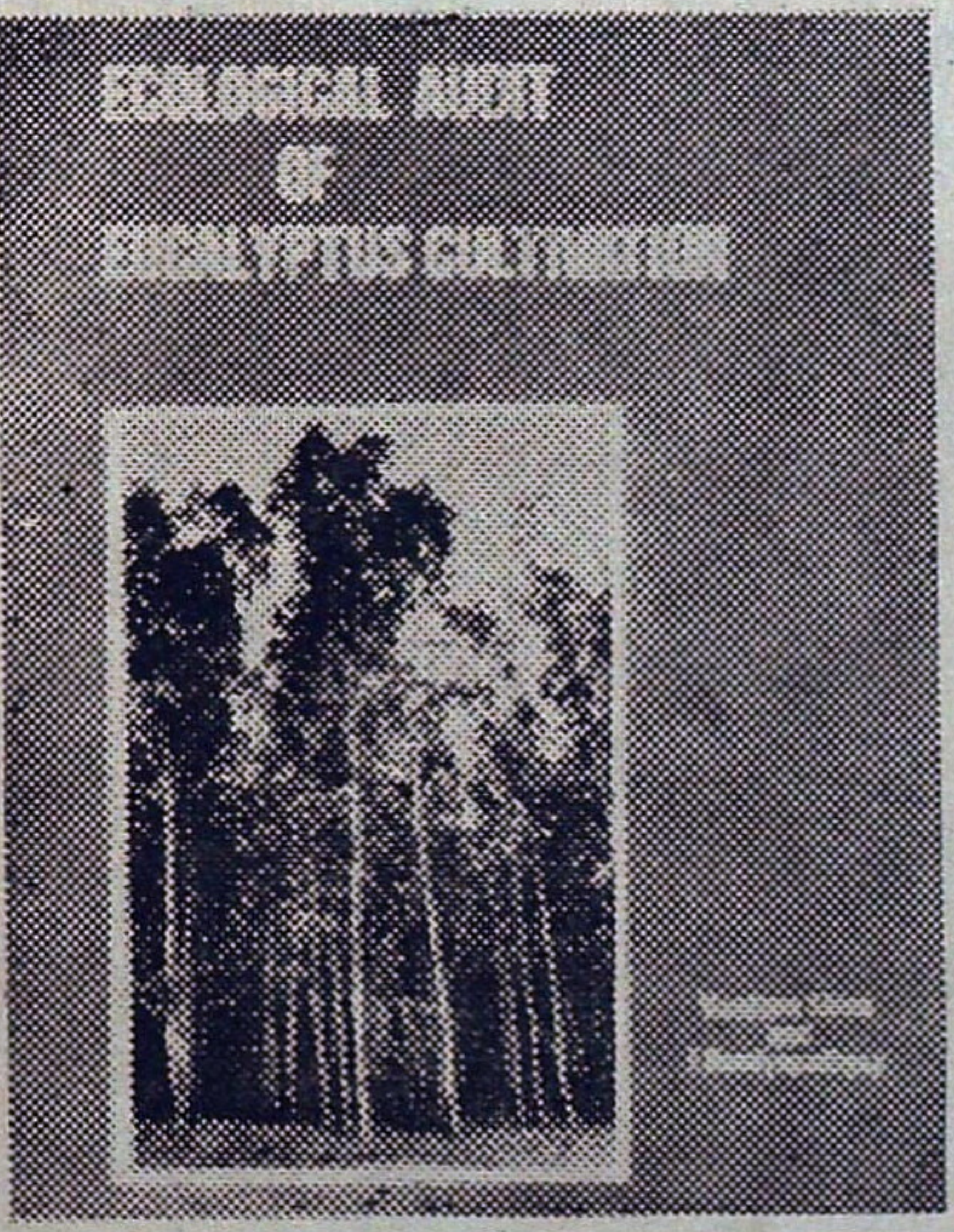

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